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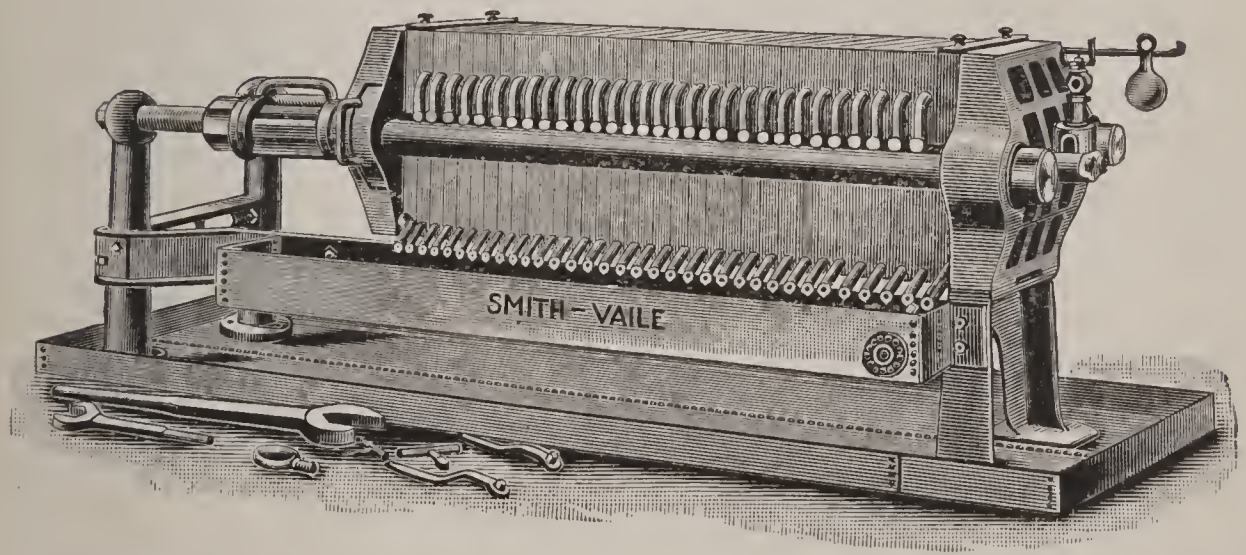

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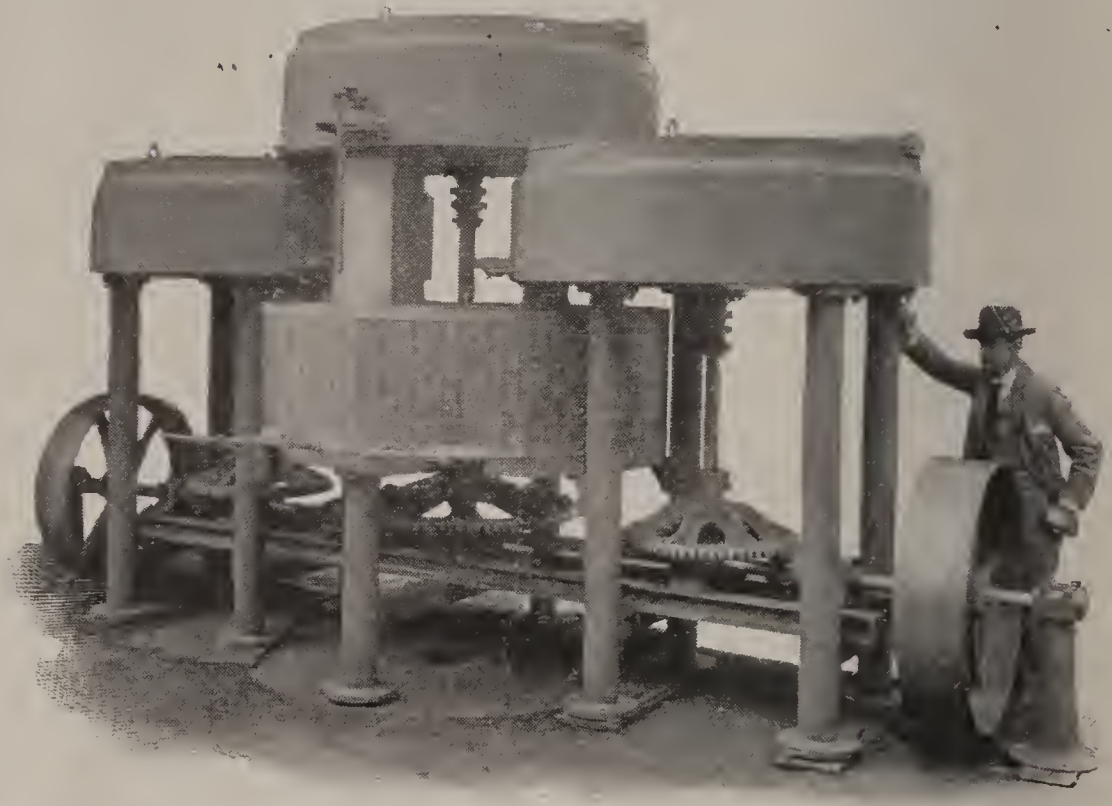

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PREFACE.

We take especial pleasure in presenting the following work to the trades coming within the scope of the cotton oil industry. The first place may be justly accorded oil milling proper, to which important subject we have given extended consideration.

It is needless to say that the business, as conducted to-day in numerous instances, viewed from a manufacturing standpoint solely, is not in that state of perfection in which it should be, partly due to mismanagement with its unfailing accompaniments, and partly due to lack of knowledge of the latest methods of manufacture. Of course this statement does not cover the entire seed crushing business. In New Orleans, La., Houston or Waco, Tex., and other important centers, splendidly equipped mills are in regular operation, the system guiding the latter being of a high order. Nevertheless, we have reasons to know, there is room for improvement in the best. For these, as well as to the most unpretentious of plants, a careful perusal of these leaves, and adherence to the principles propounded, will be found invaluable.

Considerable of the matter has been previously produced in the columns of THE NATIONAL PROVISIONER, but it has been thoroughly revised and reconstructed, a very considerable amount of new material being added and old eliminated, bringing the work right up to date, and making it, therefore, more interesting and valuable to the oil miller, refiner, lard compounder and soap maker.

It should be considered that English technical literature in the especial line which we treat of is deficient, inasmuch that no previous work has been issued which exclusively considers the important points exhaustively covered in our present publication. In works on oils, fats and allied industries, an insignificant space is usually allotted to the subject of cottonseed oil milling, while theoretical rather than practical views are predominant.

We have endeavored to give a clear, concise and comprehensive outline of the business as it is conducted, describing the improvements which we consider would prove beneficial, and herewith submit the book to the trade and to those interested in the industrial lines referred to, especially, feeling assured of their appreciation of our work as we are of its general merits and usefulness.

We beg to thank our numerous friends for the large number of orders and encouraging letters received prior to publication, and we hope to merit the continuance and good-will thereby expressed.

ROBERT GANZ & COMPANY,

Publishers of *The National Provisioner*.

The Organ of the Provision and Meat Industries of the United States.

NEW YORK,
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THE MANUFACTURE OF COTTONSEED OIL

AND

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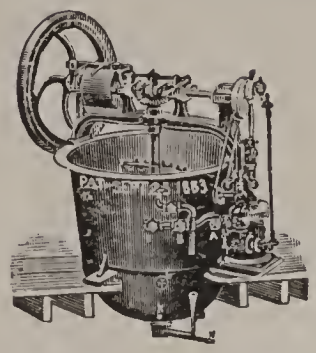

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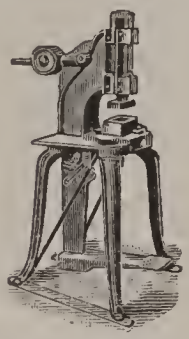

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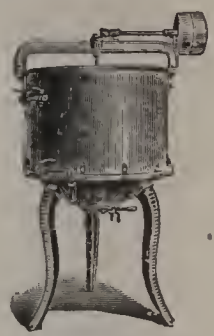

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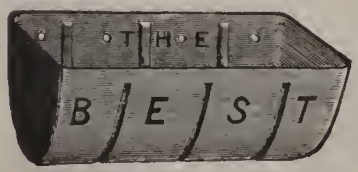

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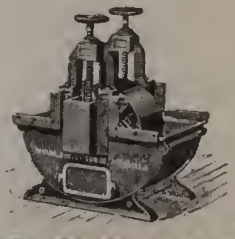

COTTON-SEED OIL MANUFACTURE.*

THE FUNDAMENTAL PRINCIPLES OF OIL MILLING.—A SYSTEMATIC ANALYSIS OF CAKE INDISPENSABLE.

To the modern oil miller a thorough knowledge of the technical detail of the various manufacturing processes becomes an essential condition of success. Furthermore, the knowledge must be acquired in a practical manner, if salutary and permanent results are to be obtained. Ten or twelve years ago, in cotton-growing districts, where an abundantly reproductive soil furnished lavish supplies of seed at low prices, the prospect of reaping a golden harvest by transforming the crude material into the manufactured products of oil and cake was of the most alluring character. It was recognized that the oil commanded a high figure, while the cake could be readily disposed of on a permanently active market—conditions which are remarkable by reason of their absence in current times. The facilities with which supplies could be obtained, and the knowledge that the manufactured products gave more than a reasonable guarantee of early and profitable returns, materially enhanced the value of the business, and attracted the attention of many to whom its peculiar characteristics were utterly unknown.

Mills sprung up as if by magic, and the whirr of machinery was heard for the first time in many of the distant cotton-growing districts. The opinion was wide-spread that he who used the most seed, and therefore made the most oil and cake, made the most money. Unfortunately, this fallacious impression obtains in very many quarters to-day. The seed was rushed through each of the manufacturing

processes—linting, hulling, rolling, cooking, and pressing —regardless of the fact that no more wasteful method could be possibly pursued. The system is prodigal in the highest degree.

This was unavoidable, owing to the peculiar conditions which controlled the situation. In extensively cultivated cotton districts, such as are to be found in the South, in which a new industry of wide proportions and illimitable possibilities suddenly started into life, the logical consequence was that many who saw the trend of the times, and were possessed of sufficient financial stability, determined to improve the opportunity by embarking into (to them) an unknown and difficult manufacturing industry. But the incentive was too salient to withstand—that of metamorphosing the hitherto considered worthless crude material into the valuable manufactured products of oil and cake—and if any scruples were entertained as to their incapacity concerning the management of the business thus opened out to them, they were speedily overcome, and the work of mill construction and subsequent manufacturing went on apace.

The knowledge of the requisite machinery, methods of operation, or the fundamental principles which govern the manufacturing processes, was limited to comparatively few. Mills were erected and put into operation frequently under the immediate supervision of incompetent men, without the mature deliberation which such an important undertaking deserved. The men referred to claimed the significant appellation of experts, and were said to be identified with linseed-oil interests in the Northern States, but their claims were far from being sustained by subsequent results. Not a few plants were put together lacking the indispensable requirements which are concomitants of efficient work, while a thoroughly equipped mill, where such was in operation, was conducted on principles foreign to regularity, and therefore detrimental to permanent success.

The ruling prices of the crude and manufactured products were auspicious—that is, seed was obtainable at a very low figure, while oil commanded a very much higher price than has since obtained, and more than double the current figures. These were circumstances which enabled the crusher to meet current obligations, notwithstanding the presence of wasteful processes, and coincidently leaving sufficient margin of profit to excite the interest of others who were contemplating similar action by launching into the spreading industry.

Under these peculiar circumstances the crusher could afford to disregard many of the forms in the respective processes, of which he was doubtless ignorant, and of which a strict adherence thereto becomes one of the indispensable features of modern oil milling. This is owing to a complete reversion of former conditions, high prices for seed and low prices for oil and cake, the situation being intensified by the existence of keen competition.

The latter conditions now obtaining, the prudent manufacturer is constrained to estimate his prospective profits on the basis of systematic and economical methods, unremittingly maintained from the moment the seed is caught up to be denuded of the adhering cotton, until it leaves the hydraulic press in the form of oil and cake.

It is an incontrovertible fact, as determined by the writer on numerous occasions by analysis of cake, that the great majority of mills, even those constructed under the most approved plans, permit a very much larger proportion of oil to be left in the cake, by reason of defective work, than is consistent with efficient management. It is therefore palpable that a mill may be equipped in first-class fashion, possessing all that is essential in the production of satisfactory results, and yet wasteful methods characterize its operation. For instance, it is impossible to procure good results unless a regular feed be maintained on the rolls,

and adequate time taken for heating and agitating the contents of the kettle, while the final process—that of the oil expression by hydraulic pressure—should be maintained unrelaxed for at least thirty minutes. By rushing the feed through the rolls, to make time, the seed is imperfectly ground, which, together with curtailment of the normal cooking period in the heater and of the requisite time for the perfect extraction of the oil in the hydraulic press, produces a high percentage of oil in the cake as the inevitable result. However efficiently the succeeding processes may be maintained, the normal proportion of extractable oil cannot be procured if the rolling process be irregularly conducted. A slow and uniform feed, ground by a set of perfectly true rolls, is, after the linting and hulling processes, the first important step in economical work.

In addition to the regular cake analyses which should be maintained, the use of scientific apparatus of an inexpensive nature, and requiring but little attention, will enable the manager or superintendent to keep in touch with every part of the mill, of whatever capacity, and to regulate the respective processes with unerring precision. The system which the writer purposes placing before the seed crushers and refiners of cotton-seed oil has never been previously suggested in connection with that industry. Its introduction will prove of incalculable service from a practical and economical standpoint, and it will be described in detail in succeeding pages.

EXTREMES OF TEMPERATURE IN COOKING THE MEALS EQUALLY WASTEFUL.—SHORT TIME PRESSING BANEFUL IN ITS RESULTS.—THE STEAM PRESSURE-GAUGE AN IMPORTANT FACTOR IN THE ATTAINMENT OF EFFICIENT WORK.

As pointed out in the first article of this series, the presence of a defect in any of the processes deleteriously affects

the succeeding one and the final oil yield. However efficiently the seed may be ground on leaving the rolls, if the treatment the crushed material is subjected to in the heater be either in excess of or lacking the normal temperature, the results will be of a decidedly unsatisfactory nature and proportionately destructive.

In the case of a reduced temperature, from whatever cause—omission being the primary one—the subsequent operation produced by the hydraulic press, however prolonged and maintained with unrelaxed pressure, will fail to extract that proportion of oil which should be obtained under normal conditions.

If, on the other hand, it be found that an excessive temperature has been maintained in the crushed material in the heater—while all the extractable oil may have been obtained—unfortunately, a circumstance of rare occurrence in conjunction with efficient methods in a Southern cotton-oil mill—investigation will reveal the fact that it is at the expense of destroyed bagging and hair matting, where such is in use, and discoloration of the oil. The increased temperature and the maximum pressure acting simultaneously on the woven material, stretch and rend it long before the expiration of its regular period of utility has been reached. The writer has seen new press bagging of the camel-hair variety destroyed in a few hours by this pernicious neglect, while the weaker fabric, of which a great quantity is in use, under similar conditions is fractured at the first charge.

When the aggregate loss entailed by the destruction of the expensive press bagging and incidental sequences of an equally baneful character, are considered on the one hand, and the loss of from one to seven gallons of unextracted oil per ton on the other, the adverse financial situation in which the majority of the cotton-seed crushers have been placed may be readily understood.

Again, let us suppose that we have gone through the

respective processes in the most efficient manner, until the action of the hydraulic ram is called into requisition in the prosecution and completion of the work. Should the irregular action of the pressure caused by leaks or the reduction of power at steam boilers superinduce a relaxation, the practical work which characterized the preceding processes will have been rendered abortive to a very material extent.

"Furthermore, the abridgment of the period essential to the thorough extraction of the oil at the maximum pressure, to permit of more frequent charges, presents similar conditions. It is a notorious fact that the latter reprehensible system is wide-spread, and that the policy of rushing through the respective manufacturing processes, the greatest possible quantity of material, to the utter disregard of practical and economical principles, has too many adherents.

Clearly, the defective principles here demonstrated indicate the urgency of speedy reformation. A reversion of existing conditions is easily within the reach of every manufacturer. By supinely tolerating their continuance the evils which have encompassed him in the past are more than likely to be reproduced in the future. A mill in one district may be prosperous owing to efficient management, while that of another may be in adverse circumstances from its inability to successfully compete at current prices with modern innovations and more practical and, therefore, economical methods.

The first step in the amelioration of these conditions consists in commencing at the fountain-head—the boilers, which are the seat of power, and upon the regularity of which, with regard to the heating and pressing operations, respectively, much depends. Fluctuations of steam pressure in oil mills are probably more pernicious in their results than in that of any other industry. To obviate this difficulty, to detect immediately and record such occur-

rences at whatever time effected, the initial step to economical work consists in connecting a recording pressure-gauge with the boilers. Apart from the very essential manufacturing principle involved, safety and economy are best subserved in the management of the boilers by the use of this silent and incorruptible witness. Its presence serves to stimulate the flagging zeal of the indifferent fireman to renewed efforts in the attainment of uniform pressure not only on the boilers, but on the direct-acting steam hydraulic pumps, where such are in use, on the jacketed heater and throughout the entire steam connection. The watchful attendant on whom devolves the duty of regulating the steam in heater jackets and that proportion which is blown directly into the crushed and agitated material in the interior, is thus enabled to alter the conditions according to the nature of the meal with a degree of certainty impracticable under irregular or reduced temperature. For illustration, let us suppose that for some reason the steam pressure in boilers is relaxed, so that it is difficult, if not impossible, to temper and correctly treat the material suitably, yet not reduced sufficiently to bring the engine to a standstill, the natural sequence is that, owing to inadequate manipulation, the hydraulic pressure in the succeeding operation fails to extract the normal proportion of oil, and the crusher is just so much the loser. The recording gauge automatically registers the occurrence on a uniformly moving chart, thus obviating any efforts at concealment on the part of those responsible for such casualties. The salutary effect of the knowledge that an investigation will surely follow such a delinquency, acts as a powerful deterrent.

THE RECORDING THERMOMETER USED TO INDICATE PAST CONDITIONS PRESENT IN HEATER.

The next proceeding in the attainment and continuance of uniformly practical work consists in the introduction of

the same principle in connection with the heater, with this difference—that the temperature is gauged and recorded instead of the pressure. The steam pressure recording gauge has long been utilized, and with uniformly good results, in connection with steam boilers, but the recording thermometer has never been used as a means of establishing the past conditions present in the heater. Its feasibility and the success which has attended this device in other industries, impressed the writer with the conviction that it can be used to very great advantage in the manufacture of cotton-seed oil and cake. It will respond to a long-felt want in a most convincing manner, by solving one of the most difficult problems in oil milling—that is, the attainment of absolute uniformity of temperature throughout the treated material. The recording thermometer, which may be adjusted to the side of the heater, would be connected by a small, flexible copper tube, with a small coil suspended in the interior of the heater, in such a position that the arms of the sweeps, or agitators, will clear it, and yet be situated where the treated material is most affected by the live steam which is blown in direct from the boilers. The coil must be protected in a suitable manner. The interior of the recording part of the apparatus consists simply of the helical form of recording pressure-gauge, while the coil suspended in the heater would be partially filled with alcohol, which latter produces variations of pressure according to the ruling temperature, the latter being exactly recorded on the accompanying chart, which makes one complete revolution every twenty-four hours.

This chart may be looked upon as the unerring medium for recording the incontrovertible history of the conditions which are obtained during that period. These can be removed daily and placed in an album which is specially provided for the purpose.

The value of this faithful conservator as an untiring re-

minder of current delinquencies to those responsible is thus readily understood. Its presence will hold the attendant strictly to the duties which he is expected to perform, and upon which so much depends in the successful termination of the processes. The changing conditions which distinguish the ground material in the heater exact unremitting attention in grading the temperature to the appropriate degree. This device has been successfully introduced in other manufacturing industries where uniformity of temperature is a desirable feature, but to none is it of more consequence than to the seed crusher.

A steam pressure may be maintained uniformly in the boilers, and yet be very insufficiently applied to the meal in the heater, or the reverse (and perhaps equally reprehensible) condition may prevail in the form of excessive temperature, owing to irregular and infrequent manipulation of the steam valves. As in the case of the fireman, the heater attendant is perforce compelled to closely watch the constantly varying temperature of the ground material and apply or reduce the amount of steam, either in the heater jacket or for that which is blown directly into the meal, in conformity with the ruling conditions. Failure to maintain uniform temperature, whether on the day or night watch, means sure exposure, as indicated by the chart, and the sequel to this, which he doubtless dreads, will be obviated by efficient work.

Necessarily, the changing conditions of the meal in the heater—owing probably to the fact that, among other causes, one portion of the seed may contain a greater proportion of moisture than that which has just preceded it, or the reverse—will show a corresponding difference on the chart, but it will not be of sufficient significance to affect the final oil yield if the steam heater valves are simultaneously regulated. When the engine slows down at the noon or midnight meal hour, or at any time that it is found neces-

sary to bring the mill to a standstill for a period exceeding three or four minutes, it is of the greatest importance that the steam jet valves should be shut off and the exhaust valves connected with the jacket closed, if in use. Neglect of this will assuredly cause the substance to be heated and saturated with moisture far beyond the point where economy ceases. This overcooked material, when subjected to the subsequent pressing operation, will spread in the effort to escape the gradually increasing pressure, and in so doing carries the press bagging material with it, thus rending and in a comparatively short time destroying it effectually. On the other hand, in the event of the valves having been shut off at the proper moment, but through omission are left in that situation for a greater or less period after the engine has been again put in motion and the manufacturing processes resumed, the results are similarly pernicious in their far-reaching influence, as demonstrated by the inferior oil yield and a correspondingly high percentage in the cake.

These culpable conditions, which have so frequently met the astonished eye of the superintendent, the manager, or the proprietor, as the case may be, on his arrival on the mill premises in the morning, and to whom the whole affair may appear inexplicable, whether it be destroyed press bagging or inferior oil yield, may interpret the origin of the difficulty by the foregoing details. The temptation which the small hours of the morning sometimes present to indifferent press-room help to relax their regular routine of duties is readily overcome, owing to the presence of such an unimpeachable witness in their midst.

On an occasion not remote the writer stepped into a press-room at 1.30 A.M., on the night watch, and, while the surrounding conditions seemed normal, a closer investigation revealed the fact that *the contents of the heater were cold*, owing to the steam valves having been left untouched from the time they had been shut, when the engine slowed down

at 12 M., for the double purpose of oiling up and partaking of meals. The engine having started up at the expiration of the regular half-hour, the rolling, moulding, and pressing had been maintained without the slightest application of steam, through the unpardonable neglect of the heater attendant, who had been in the meantime called from an out-of-the-way quarter, where he had been quietly enjoying a sound sleep, blissfully indifferent to the fact that during the period that he had been absent from his post of duty, an amount equal to many times his daily stipend had been irrecoverably lost.

To procure the normal proportion of oil it is absolutely essential that the meal should be efficiently treated, which desideratum is only acquired by close attention, in the form of frequent tests of the meal and correct adjustment of the valves.

These generally recognized dogmas in oil-mill ethics were equally well known to the operator who was thus derelict in his duties, and who would doubtless not have been caught napping had any restraining influence been brought to bear, such as the telltale thermometer. Not only was this man discharged, but so also were the two men whose work was in close proximity to the neglected heater—a fate which they justly merited, owing to the palpable indifference they displayed to their employer's interests by silently tolerating such wasteful work.

The use of a recording thermometer would at once disclose any defect in the heater in the form of a flaw or crack. The leaks resulting from such render it impracticable to turn out a uniformly cooked product, and on failure to caulk or stop such leaks, whether in a single casting or wrought-iron heater, the apparatus should be abolished for a new one, and by so doing economy is best subserved. The trustworthy operator would welcome the presence of such an innovation, for the reason that, should any defect be

demonstrated of a serious nature, such as a low oil yield, the thermometer chart, showing a uniform temperature throughout his watch, is a guarantee of duties faithfully performed, and an indication that the rolling or pressing operation is at fault instead of the cooking.

PRESSURE AND ITS CORRECT APPLICATION IN THE OBTAINMENT OF THE EXTRACTABLE OIL.—THE RECORDING HYDRAULIC PRESSURE-GAUGE AN INVALUABLE AID.

Having proceeded thus far in the respective processes, assured that nothing has been left undone that would further facilitate the expression of the oil or improve the standard of the work executed, the next important and final step consists in the action of the hydraulic pressure. A *sine qua non* in the successful prosecution of the work yet to be done consists in uniformity of pressure. It is a fact that pressure produced by any system, however perfect the automatic arrangements may seem, will at times fluctuate by reason of some mechanical derangement in the principle used in its application, whether by the direct-acting steam pressure pump, operated in conjunction with an accumulator, by belt transmission, or by whatever system employed. Unquestionably, the best form of applying pressure is that of the former, which under normal conditions gives invariable satisfaction. But the pump and its efficient auxiliary, the accumulator, may be in thorough working order, the regular gauge indicating the exact pressure required ; yet, owing to some difficulty, revealed upon careful investigation, but a fraction of the desired pressure may have been exerted on the hydraulic ram, the inevitable result being a fractional yield of the normal proportion of extractable oil. This deficiency of pressure may have existed for an indefinite period on any particular press, during which time the manufacturer has been losing heavily. Doubtless the regu-

lar pressure-gauge, if connected to the press, would at once indicate the presence of such defective work, but the gauge is not very closely scrutinized by the average pressman, especially during the long hours of the night watch.

The system which makes possible the existence of such egregious irregularities is clearly at fault, and urgently in need of speedy reformation. Here, again, the progressive march of science may be utilized to excellent advantage in the attainment of absolutely accurate work, by the introduction of the recording hydraulic pressure-gauge. The regular hydraulic gauge, while indicating current pressure, is useless as a reflector of past conditions. This fact fosters inattention, and is an unfailing source of incipient trouble, which at times is developed to an alarming extent—conditions which rarely or ever appear on the surface, but which are demonstrated by the imperfect yield, a circumstance which is invariably attributed to poor seed or some other cause.

Referring further to the ordinary hydraulic pressure-gauge, a relaxation of from five hundred to a thousand pounds pressure per square inch may have been maintained for an indefinite period, the regular hydraulic gauge at the time showing the true condition ; but the return to the normal pressure and the simultaneous indication thereof on the gauge dial effectually blot out the events of the past. During the period that the reduced pressure was maintained the manufacturing processes were in continuous operation ; and the inadequate pressure failing to extract the normal proportion of oil, a high percentage is left in the cake, which as oil is utterly lost to the manufacturer.

It will thus be seen that the efficient work which may have preceded this serious anomaly will have been nullified —the object for which the pressing operation has been called into requisition being materially frustrated—owing to the failure of the press to perform its regular functions.

The subsequent analysis of cake reveals the true condition of affairs ; and while it is too late to avert the evil already effected, the knowledge thus demonstrated by analysis enables the manager or mill superintendent to fully realize the gravity of the situation and to adopt precautionary measures to obviate similar occurrences in the future.

By connecting a recording pressure-gauge to the pump—or, better still, to each press—the history of the twenty-four hours' previous work is unimpeachably recorded. Some forms of gauge now on the market have the marking pointer attached to the tube, and, actuated by the applied pressure, it has a tendency to uncoil or straighten, a circumstance which causes the marking arm to move around the range of the chart without the necessity of any intervening device. This gives a continuous record of the pressure brought to bear on the ground material, and its adaptation would be a decided advance in modern oil milling.

The method of treating the crushed cotton-seed in the heaters differs slightly from that of linseed when being manipulated in the manufacture of linseed oil, although the same general principles govern the manufacture of all vegetable oils.

Some varieties of seed contain a much higher percentage of moisture than others, especially when recently removed from the plant. To the latter class cotton-seed belongs, and in the case of green seed, instead of adding artificial moisture in the form of steam blown directly into the crushed material in the heater, heat radiating from the jacketed heaters is brought into requisition to remove the surplus natural moisture, the presence of which would otherwise be destructive of the press bagging in the final pressing operation. The foregoing reference with regard to the introduction of live steam in the crushed material in the heaters, had more direct bearing on the linseed than the

cotton-seed pulp in heaters, but the lack of sufficient heat in heater jackets in cotton-seed oil manufacture is as baneful in its results as in linseed oil manufacture. In nearly every variety of linseed, excepting the watery and unripe product, a certain proportion of steam must be blown into the crushed material in the heater, in addition to that which should be always maintained in the jacket, to facilitate the flow of oil. Cotton-seed which has been in storage for a prolonged period, during which the proportion of natural moisture has largely decreased, will also require the application of live steam in the heater if the correct proportion of extractable oil is to be procured.

There are a large number of mills in England which operate cotton-seed and linseed alternately by means of the same machinery, which, of course, includes heaters. The cotton-seed used is chiefly of the Egyptian variety, and a certain proportion of steam is forced into the meal in the heater in every instance to replace the natural moisture evaporated by reason of the prolonged period between the removal of the seed from the cotton plant and its treatment ultimately by the crusher. These conditions obtained in this country for many years; but as the interests of the crushers are best served by working off the seed as soon as possible after the crop has been gathered, with as brief a storage duration as possible, to avoid heating, etc., and in conformity with the methods heretofore referred to, heaters specially constructed are now used, having large areas, so that an extended surface of the cotton-seed meal may be subjected to the dry heat emanating from the surrounding jackets and bottoms, thus procuring a thorough dissemination, thereby effecting evaporation of the surplus moisture in a more satisfactory manner than was heretofore possible by old methods.

MODERN HEATERS, THEIR CONSTRUCTION, AND MODE OF OPERATION.

In the manufacture of cotton-seed oil various forms of kettles or heaters are used. Two recent innovations, materially differing in design, though similar in principle, and constructed by different mechanicians, are now in operation in some mills, and it is claimed for each that they obtain a better cooked material than is obtainable by any other contrivance. As a proper temperature in the treated material is of vital importance, no pains should be spared which conduce to this result. In order to produce a uniformity of temperature, great efforts have been made to devise appliances by means of which the manipulation of the meal may be facilitated.

It is essential to maintain a certain temperature consistent with prevailing atmospheric influences, and the acquisition of knowledge to efficiently perform this highly important process is secured only by practical experience. The arrangement now in operation in the leading mills consists in three kettles, or heaters, so organized that while one is delivering a cooked charge, another is preparing a second charge, and the third heater is receiving its *quantum sufficit*, to be in readiness for the succeeding cooking operation, the heat radiating from the bottoms and jacketed sides of the heaters continuously driving off the accumulation of natural moisture in the crushed material.

The heaters included in the various designs differ in size proportionate to the capacity of the mill. The design and mode of operation of the class including three in a single combination, and by the correct use of which a uniformly tempered product is obtained, is as follows: Two kettles, or heaters, which we will call Nos. 1 and 2, are placed

in an elevated position and resting on top of the lower heater, which will be represented by No. 3, the lower part of the latter being about four feet from the floor, and the whole supported by stout iron columns. The point at which the peripheries of the two upper heaters adjoin is immediately over the centre of the lower one.

In order to more fully describe the cooking operation, we will suppose it is Monday morning and the mill is about to commence the first watch of the week. The heaters are clean and, everything being in order, the engine starts, and soon the complicated mechanisms of the numerous machines are set in motion. The feed is turned on the rolls and the real manufacturing processes have fairly begun. The crushed seed is continuously elevated from the hopper beneath the rolls and falls in No. 1 heater until it contains a sufficient quantity, when it is shut off and permitted to fall into No. 2 heater.

Probably the form of heaters most suitable in the manufacture of cotton-seed oil, and that which has come into general use in the leading mills, and a large proportion of those of recent construction, consists in a set of three, situated in a continuous position and on the same plane. Under the heaters, and immediately beneath a segment of the circumference of each, a steam jacketed conveyer passes the treated material to the moulding machine to receive preliminary formation, prior to being subjected to the action of the great hydraulic press.

The arrangement of three permits an extended time for the dry heat evolved from the steam space around and beneath the heater to radiate throughout the crushed seed, and very materially facilitates the driving off of excessive moisture, when such is present.

The steam jacketed conveyer was designed with the object of maintaining continuously a uniform temperature on the crushed material from the moment the latter falls into

the heater until withdrawn from the conveyer, to be shaped into cake form, thereby producing uninterrupted and prolonged evaporation. The utility of such design, both in the form of heaters and conveyer, will be readily appreciated by the crusher whose raw material is similar to that which is offered in various districts in Texas, South Carolina, and other cotton-growing sections at the moment. The conditions which govern the cotton-seed market in these States and the quality—green, and consequently full of moisture—should act as salient incentives in pursuing the most economical course in the obtainment of best results. By exposing as large a proportion of the meal as possible to the action of the heat in bringing the former into direct contact with the steam jacketed sides and bottoms, a more perfect evaporation of moisture is obtained in the heater.

The sweeper or agitator revolving with the vertical shaft around the bottom, by continuously changing the position of the meal, facilitates the dissemination of the heat throughout the latter. A body of crushed seed eight or ten inches deep can be treated much more effectively in the heater than one of twelve or fourteen inches, owing to the fact that the former being less dense, the heat is more uniformly distributed, and more satisfactory results accrue. Here the superiority of the modern system of cooking over the older is made manifest. With a single heater from which charges were frequently withdrawn in rapid succession, as in the case of this now obsolete method, as far as cotton-seed oil manufacture is concerned, a uniformly cooked material became absolutely impossible to procure. The material was permitted to fall into the heater rapidly and withdrawn similarly, the cooking period being inadequate, owing to the generally crowded condition of the latter, and the ruinous policy of setting a standard time for the output of a certain daily amount of oil and cake, or, in other words,

for the consumption of a stated quantity of seed in a specified time, regardless of the means adopted for its accomplishment.

The mode of procedure with regard to the charging and emptying of the heaters in the three-set system, is conducted so that the contents of each will have been subjected to the same period of treatment, and the proportion of heated or cooked material permitted to fall into the steam jacketed conveyer beneath being the same, as nearly as practicable, in the respective heaters. On the commencement of operations on first watch of the week, Nos. 1, 2, and 3 heaters are charged in the order named. The feed should be so graded, that by the time No. 3 heater has received its *quantum sufficit,* the contents of No. 1 should be ready for the moulding machine, and so on continuously. By means of a conveniently arranged lever, attached to the bottom of each heater, a movable slide is removed, the cooked material falling to the conveyer, to be carried along to the mould. The formation of the heater sweeps exerts considerable influence in the agitation and changing of the position of the material.

The heat at once begins to act on the crushed seed, and is uniformly disseminated through the mass by the action of revolving agitators which sweep around the bottom, carrying the meal partly around at each revolution, thus momentarily changing its position, and preventing any portion from being singed or burned. When the charge in No. 1 kettle is sufficiently cooked, the withdrawal of a slide permits it to fall into No. 3, beneath, and at the same moment the cooking process is commenced in No. 2 kettle, which by this time has had a full complement of meal conveyed to it. The feed from rolls is now directed to the first, or No. 1 kettle, which at this point is empty, having discharged itself into the lower kettle.

When the cooked meal has been withdrawn from the lat-

ter kettle for its preliminary formation, prior to being subjected to the action of the hydraulic press, the material in No. 2 kettle is prepared, and permitted to fall into the lower kettle, now empty by reason of the withdrawal of the charge for the final processes, the successive operations being continuously maintained as described.

In almost all manufacturing industries, heat and the effects produced by its agency, take precedence of all others. In the production of most manufactured products, it will be found that in some essential process pertaining thereto, heat of greater or less intensity will be utilized in some form or other. The perfect extraction of oil from vegetable substances by hydraulic pressure is very materially dependent on this principle. To cotton-seed the application of this principle is of peculiar significance, and probably of greater moment than in the case of any other. Without heat and moisture in sufficient proportions, the extractable oil will remain in the crushed material, however efficiently the pressing operation may be maintained.

THE DIFFICULTY EXPERIENCED IN TREATING COTTON-SEED MEALS SO AS TO PROCURE BEST RESULTS.

Cotton-seed, of all known vegetable substances the oil from which is extracted by hydraulic pressure, is probably the most difficult to manipulate. The greatest drawback in the manufacture of cotton-seed oil consists in the changing conditions of the seed, necessitating special treatment for each phase. Meals containing an abnormal proportion of moisture and of inferior quality, require prolonged treatment for the evaporation of the surplus moisture to prepare them suitably for the pressing operation. These untoward conditions confronted the seed crushers of South Carolina and parts of Texas recently, and in the event of the first run of the season's seed being sufficiently remunerative

to meet current obligations, not a few considered themselves fortunate. The relatively high price for a comparatively inferior material exercises a salient influence on this vital question. Under these unfavorable conditions the greatest care must be employed in the avoidance of waste, by strict adherence to the fundamental principles of oil milling, or most assuredly the manufacturer will ultimately discover his financial balance on the wrong side of the ledger.

As the season advances the material will, however, prove of better quality, and the prospective profits be augmented in the same ratio.

The uniformity of moisture which may be present in other varieties of seed, linseed for instance, enables the manufacturer to proceed with the complemental processes at regular intervals, continuously maintained from watch to watch, and from week to week, without serious interruption. In well-regulated linseed-oil mills a certain amount of oil and cake, or in other words a regular consumption of seed and corresponding number of press charges, is effected weekly. Excluding break-downs of a serious nature, the stipulated aggregate of manufactured products is thus regularly turned out with a degree of absolute certainty. The proportion of moisture present in all varieties of linseed is comparatively uniform. Probably the most immature contains but little over seven per cent., while the East India variety contains very much less, by about two-thirds. It will be thus seen that in the manufacture of linseed oil, the heater operator, by *close attention*, is enabled to turn out a uniformly cooked product by means of slight alterations of the valve positions to meet the requirements of the material under treatment. Owing to this fact, an automatic signal is operated in the leading linseed-oil mills, by means of which the operatives are apprised that the moment has arrived when the press must be low-

ered, emptied, and recharged. In connection with this automatic signal a register may be brought into requisition, by means of which the exact amount of work done by the mill may be ascertained at a glance at any hour during the week. The register simply records the number of strokes the automatic signal has made, which number corresponds to the number of pressings effected up to that moment, thus demonstrating the exact amount of work performed.

The use of an automatic announcer of this description becomes impracticable in the operation of cotton-seed oil mills, owing to the variable nature of the seed—a circumstance which places the manufacturers at a decided disadvantage, as compared with other industries of the foregoing description. No comparatively reliable calculation can be made concerning the consumption of the raw material in a given time. Nevertheless, cotton-seed is operated with the same regularity in English mills to-day as the linseed, the material being in the main of the Egyptian variety. A number of years ago, the writer superintended the operation of a mill in England, run on this principle, the seed being, however, undecorticated, and the method—now almost obsolete in that country—being the old box press.

Seed produced by our soil, however, requires very different treatment, and in view of this fact and for the purpose of obtaining a uniformly cooked product in a stated time, so that the business may be conducted on a systematic basis, similar to that of the linseed crushing industry, the writer designed the following form of heater several months ago. The peculiar characteristics of American cotton-seed and the special requirements essential in rendering it a suitably cooked material, consist in manipulating the substance in the heater so that the heat may radiate throughout the mass in the most effective manner possible. Obviously, the less densely the meals rest on heater bottoms, the more surely and rapidly the influence of temperature will make

itself apparent, and for the same reason the more perfect the mixing will be. The heat radiating from the steam spaces will more readily permeate the mass.

And the continuously recurring motion of the sweep or agitator will materially facilitate this action. The most feasible design to procure a thoroughly cooked product, from the writer's standpoint, should consist of a three or four chambered cylinder, somewhat similar in design to the latest innovation, but differing from it in this important respect: more than six inches of the crushed seed should not be permitted to enter each chamber while undergoing treatment, and instead of having the sides steam jacketed, the space between the real and false bottoms of each chamber would be found to be sufficient for all purposes. With the density of the material limited to this amount, the action of the agitators would cause a continuous changing of position of every particle of seed, and at the same time facilitate the introduction of heat from the bottom.

Where a density of from eighteen to twenty-four inches of meals is being treated in one chamber, a uniform quality of work under any conditions becomes practically impossible. Masses will be discharged into the measuring-box at a comparatively low temperature, followed by an equal amount of over-heated material, the former lumpy and of irregular character, the result being an inferior yield of oil, and where the over-heated material is withdrawn in sufficient quantities the destruction of the press bagging will be the natural sequence. Treating the material in large masses as described, promotes the formation of lumpy matter, the interior of which heat cannot penetrate, and judged from any standpoint, is a very inefficient mode of treatment.

The formation of a heater, such as suggested, would consist of four upright stanchions or hollow iron supports at equal distances apart, and at a point about four feet from the floor surface the real and false bottoms of the lower

chamber of a series of chambers would be attached, with openings in the centre, to permit the entrance of a vertical shaft to operate the agitators, suitable space being left between each, the circumference being enveloped by large hoops or sheet-iron bands, perhaps eight or nine inches wide, in four sections to each chamber, a section embracing one-quarter of the circumference, or the arch formed between each support, to which latter they would be firmly bolted, and in such a manner that the bolts and nuts would be easy of access. In the event of it being found necessary to inspect the interior of a chamber, the removal of one or more of the bands or sheeting which thus form the side of the chamber, would be easy of accomplishment. In order to obviate crowding and a greater density than six inches of meals in each chamber, long narrow openings, probably one inch in width, could be made in the bands, about six inches and a half from the bottom of the chamber, which would have the effect of causing the seed to fall to the floor, and thus promptly draw the attention of the operator, causing him to check the feed.

Irregularity is an unavoidable feature of work on resuming operations after the mill has been closed down for a period extending over a few hours. Everything is cold—heaters, jacketed conveyers, press plates, *et al*—and not until three or four hours have elapsed after the first revolution of the engine has been made, can it be said that the respective processes are maintained with anything resembling uniform work.

But this irregularity, under careful treatment, should cease at the termination of this period.

The narrow and extended openings referred to in heaters which we have now under consideration, could be utilized to good advantage during these brief periods of immature work, but, after uniformity had been established (that is, regular charges entering and withdrawing from heater con-

currently) small sliding gates would effectually enclose the material. Sufficient heat could be imparted to the meals to obviate any influence of an atmospheric character caused by the side openings, while on occasions when an unusually moist material would be under treatment they would materially facilitate the exit of moisture by evaporation. The *modus operandi* would be as follows: The meals on being discharged into the first chamber at the top would pass through the opening in the centre, and by the action of the agitators gradually work their way to the sides, between which and the jacketed chamber bottom on which the material is being manipulated, sufficient space should be allowed to permit of their free discharge into the chamber beneath, the latter having its discharge opening around the vertical shaft in centre, and not at the sides as in the one immediately above it.

The action of the agitators in the chamber would gradually carry the material to the central opening, which, by reason of its being the only place of exit, the meals must of necessity move in that direction, and soon in succeeding chambers beneath, until withdrawn at bottom. The material would thus perforce make a zig-zag course, continued from the moment of its entry at upper chamber until its exit through sliding gate in bottom chamber, and throughout its entire passage being subjected to a dry heat suitable to any of its variable conditions. This design might be used to equal advantage in the treatment of ground linseed, or any other vegetable substance, for the expression of the oil. In the case of the latter, where the addition of artificial moisture becomes imperative, live steam could be injected into the mass in top chamber, so that before its withdrawal into mould frame beneath, a uniformly treated product would be the result, alike free from lumps, excessive dryness, or surplus moisture, and possessing the correct degree of temperature.

It is a comparatively safe assumption that the meals thus caused to automatically traverse the heated bottoms of each chamber, every particle of which has been subjected to heat and agitation, will be turned out of a uniform consistency and in prime condition for the extraction of the unctuous fluid.

With heaters of this design and of sufficient area, say five or six feet inside diameter, a set of presses could be operated with regular and well-prepared charges continuously.

HINTS TO PRACTICAL OIL MILLERS WITH REGARD TO PRESS-ROOM APPLIANCES AND METHODS.

Owing to the fact that the first pressings are necessarily defective, a very inferior oil yield being the result, the best interests of the manufacturer are subserved by gradually reworking the cake. Although the meals encompassed in their camel-hair wrappings may possess the normal degree of temperature at the moment of their discharge from the heater, the close contact with the cold press-plates at once reduces the temperature of the treated material, a still further reduction of temperature occurring on the application of the pressure, the inevitable result being a very defective oil yield. To procure the normal proportion of extractable oil, all preceding processes being analogous, it is thus clearly demonstrated that heat becomes an indispensable element.

To obviate this difficulty not a few of the linseed-oil manufacturers use steam coils of piping between the hydraulic presses. By this means heat, equal to about 100° F., may be applied to the presses for several hours before the mill commences the first watch of the week. The night watchman permits the passage of steam through the coils at a stated time, also through the jacketed heaters, so that before the introduction of the material for cooking or press-

ing, the respective machines will be transformed from an unsuitable condition to one in uniformity with the special requirements of the case.

To still further maintain a uniformity of temperature between and around the plates of the hydraulic presses, subsequently (that is, during the period in which the oil is being extracted, and the emptying and charging of each press is carried on), a set comprising four, five, or six of the latter is enclosed by wooden erections, a glass pane in the rear permitting a view of the flowing oil, while a small hinged door in the front is permitted to remain open sufficiently long for the termination and resumption of the successive pressings of each press, respectively.

Manufacturers of cotton-seed oil will do well to closely follow the example demonstrated by the economical methods pursued in kindred manufacturing industries, as far too little attention has been hitherto bestowed on these really important matters. When the complementary processes are in full operation and a sufficiently high temperature has been obtained in the immediate neighborhood of the presses, the valve may be shut on steam coil and reopened when occasion requires. The wooden enclosures, while facilitating the maintenance of a uniform temperature, effectually ward off cold blasts from any quarter. An open window in rear of the press, through which a draught circulates, will deleteriously affect the oil yield.

In the manufacture of linseed, rape, and cotton-seed oil the writer has made an invariable practice of reworking the first pressings. Thus the surplus oil which would otherwise remain unexpressed from the residue or cake, is recovered.

The writer has analyzed cake from which the oil had been expressed by cold presses, and which revealed from fifteen per cent. to sixteen per cent. of oil, while the cake selected for analysis several hours subsequently disclosed a fraction over seven per cent. of oil. This closely approaches the cold

pressure system of extracting oil, and while the expressed fluid is usually a very superior oil and more susceptible of manipulation in the refining processes than the ordinary crude product, its continuance under ruling prices for the raw and manufactured products, would materially expedite bankruptcy proceedings involving those concerned.

Cotton-seed oil made by the cold pressure system is regularly expressed, though on a limited scale, in Marseilles, France, but a price commensurate with the cost of production is readily obtained.

It is owing to the expense incurred in heating presses, heaters, etc., which renders the operation of an oil mill a very unprofitable proceeding, unless run continuously, night and day.

It may be considered by many manufacturers that time spent in thus reworking the cold pressed material would not be so remunerative as by continuing the processes in rapid succession, the reworked material taking the place of freshly treated meals, thus retarding or prolonging the period of the consumption of seed in stock. But while it is a matter of great moment to lose no valuable time in reducing the accumulated stock in the contiguous storehouses, it is of no less consequence to subject the material to suitable treatment, so that the extractable proportion of oil may be obtained. The policy of rushing the product through the heaters and presses, under contracted cooking and pressure periods, respectively, is most reprehensible, and in the effort to obviate the possibility of heating or decomposing of the seed in stock extreme measures are too frequently resorted to. Too many of the seed crushers look at the business in a superficial manner, and, as previously referred to, base their estimate on the success of the season's run, or on the fallacy that he who consumes the most seed, and therefore manufactures the most aggregated products, makes the most money. In the end efficient work must prevail, and

in these fiercely competitive times, the manufacturer who has regarded the maxim that, what is worth doing is worth doing well, will stand out as another exemplification of the "survival of the fittest."

A very heavy item of cost with which the oil miller is too frequently confronted, consists in the enormous bills which present themselves with unfailing regularity, having in view especially the fabric which encompasses the material when undergoing pressure. It would surprise most of the manufacturers to know how easily they could cut their bill in two by giving the question the consideration it deserves, and probing the apparent mystery until the cause is unearthed and remedial measures applied. Camel-hair wrapping is by all means the best material to use, and prodigality is best subserved by substituting bastard fabrics of the mixed or cotton variety.

As the business develops, the movement for the manufacture of compound lard conjointly with the manufacture of the crude product is more than likely to have numerous followers. It is according to the natural order of things that this allied industry should eventually become practically identified with the manufacture of the crude cotton-oil. Hitherto, the business—that of compound lard manufacture—has been almost exclusively conducted by the pork packers, but the phenomenally increased demand for the latter within recent years would portend a wide field for the progressive crusher whose mill capacity would warrant the combination, and without material prejudice to the former.

REFINING AND FILTER-PRESS CLARIFICATION.

A thorough knowledge of the oil refining processes becomes an absolute necessity, before the question of compound lard manufacture can be entertained. The peculiar characteristics of the remaining substances which form its

constituents, must also be fully understood. Under any conditions the manufacturer of the crude oil should know how to refine it, and thus secure the increased profits deriving therefrom. It therefore becomes expedient for the crusher, whose mill capacity will warrant a sufficient oil-supply in the prosecution of the succeeding work—that of refining to be followed by the blending of the respective ingredients in the artificial combination—to acquire proficiency in the art of oil refining. This may be looked upon as a preliminary step to more progressive and lucrative work than has characterized the business in recent years.

The refining of cotton-seed oil is considered by many as an acquisition easily attained, and the subject is treated by many with much less consideration than its importance deserves. To produce the exact color, taste, flavor, etc.—in a butter-oil, for instance—and to meet the fastidious views of the various consumers, together with a minimum of waste in the manipulation, skill of no mean order becomes an essential requirement. The technical detail in the chemical and mechanical treatment of the oil, together with the behavior of the latter at various stages of the processes, must be familiar to the refiner in the execution of economical and therefore efficient work.

Experiments of an empirical character, with the inevitably profitless results, very frequently depress the ambition of the would-be refiner, and for the time, at least, the project is abandoned. Small lots carefully treated, according to the most approved available formula, and the changing conditions of the fluid under treatment accurately noted as the process advances, should mark the progress of first efforts. The cotton-seed oil manufacturer whose mill capacity is inadequate to the erection of large refining tanks, with complete equipment, together with the necessity of securing the services of a high-priced refiner, would do well to commence in this unostentatious manner.

The methods of refining in the various establishments throughout the country differ somewhat, and are based on the preconceived ideas of the respective manipulators. Oil refining, as carried on by the American Cotton Oil Co., is based on the same principle throughout its refining stations. Several of the superfine grades of oil, winter white and yellow, the quotations of which may be observed daily, exert but a very restricted influence on the commercial world. A very limited demand obtains for this class of oils.

The first important step in the production of a refined oil consists in separating the impurities from the newly made product. This is best accomplished by a brief period of repose to effect the precipitation of the heavy matter, the oil to be subsequently treated to the filtration process by means of the ordinary filter press. An oil which has been made several weeks, and from which the settlings have been removed, being thus well settled, can be pumped into the refining tank without filtration, but when practicable the latter process should be carried out in every instance.

The general principles which govern the refining process most in general use, consist in the treatment of the clarified oil with a solution of caustic soda lye graded to a certain strength, and in suitable proportions, in conjunction with mechanical agitation and increased temperature, for a period consistent with the quality of the oil under manipulation. When sufficient time has elapsed for the soap stock and extraneous matter generally to subside, the clear oil is removed from the former, while the soap stock is subjected to a crude system of filtration by means of which the oil which it contains is recovered. The supernatant oil is then treated to a second filtration, the result being a beautiful yellow oil.

It is a mistake to permit oil to pass through the filter press at a point above the normal temperature. It has been demonstrated, in similar treatment accorded other vegetable

oils, that an accelerated temperature has the effect of assimilating the mucilaginous or gummy matter—characteristic of all vegetable oils—during the period said temperature is maintained. The objectionable substances in solution with the oil thus pass through the filtering medium, the texture of the latter, however fine, being incapable of retarding their progress, and a sample taken from the receiving tank when the temperature has subsided, will disclose the presence of the suspended vegetable matter, which in the heated oil was imperceptible.

Heated oil will pass through the press with less pressure and much more rapidity than when cold, but the system is defective and should be discontinued. Additional time is necessary to effect the complete precipitation of the suspended matter with this system, a circumstance which unmistakably points to the inefficiency of filtration under the conditions described. When the treated oil is filtered cold, or at the normal temperature, the insoluble and extraneous matter is retained by the filter cloths, on which it deposits and accumulates, a bright oil being produced, equal from any standpoint to a settled oil. Where the filter press is not in use in the preparation of a yellow oil, the latter is sometimes subjected to a secondary heating, which has the effect of expediting the subsidation of the impurities not yet removed.

The English method in refining consists in treating about 100 gallons of the crude oil with about 6 gallons of the soda lye of 25 or 30° Beaumé and heated for about two hours at a temperature of about 200° Fahrenheit under constant agitation. Very much larger quantities are treated at a single operation in the United States, and at a much lower temperature (100° F.), together with less powerful soda lye ; the character of the English product being inferior, more energetic treatment is essential.

The winter oil is a production of the yellow (summer) oil,

made by the foregoing treatment, together with the supplementary process of filtration, and is obtained by the chilling process, the solid matter formed being known as stearine, used in the butterine and soap-making industries.

To produce the desired flavor in an edible oil various expedients are resorted to, the exact character of which is considered a trade secret. Refined oil is at times maintained at a temperature of about 140° F. for several days to produce certain results.

As a bleaching factor in the production of a white oil, fuller's-earth surpasses all other known substances; nevertheless its use is accompanied with a heavy percentage of waste, unavoidable by reason of its absorbent properties. In the filtration process, which succeeds the mixing of the earth and oil, the small percentage of the former is secured, but is heavily charged with the oil, and the cost of recovering same would scarcely pay for the labor involved. By the application of steam introduced to the filter press the charged chambers of caked earth and oil are saturated, the fluid slowly flowing, or separating from the earth with the condensed steam, leaving the used bleaching agent as a valueless product to be cast away.

The Scollay process, by means of which oil is bleached in a somewhat similar manner to the fuller's-earth system, has been introduced to some Southern refineries. Suitable ochres, such as hematite and limonite, or any similar pigment which does not injure the oil as an article of food properly manipulated and prepared for use, mixed and agitated with the oil in certain proportions will take up the gum, resin, and coloring matter, and separate it from the oil, thus purifying and refining it. From an industrial standpoint cotton-seed oil becomes more valuable as the years succeed each other. Its cheapness renders its use practicable in numerous industries, and its area of usefulness is gradually widening.

THE IMPRACTICABILITY OF MANUFACTURING COTTON-SEED OIL ON A SMALL SCALE COMPATIBLE WITH ECONOMY.

Owing to the heavy expense incurred in transporting the seed from the plantations and scattered cotton-growing districts to the mills, together with the generally low price—from the cultivator's standpoint—deriving from the trade, the practicability of introducing small oil-mill plants in the supply centres, and right on the soil which nurtures the product, has long been considered. A superficial view of the situation would endorse the feasibility of the scheme, but more mature consideration will demonstrate the fact that the manufacture of cotton-seed oil and cake on a small scale is anything but a profitable undertaking.

On a limited scale, as such a project would necessarily be, the manufacturing processes would be confronted with serious difficulties of an insuperable character.

Vegetable oils of other varieties, such as linseed, sunflower-seed, etc., are crushed and pressed in many parts of Russia, Egypt, and East India, in small quantities, and while the business is conducted on a basis of bare profit, the work is necessarily very defective. But, in the event of cotton-seed being worked similarly, the bare profit would be conspicuous by its absence, this, too, notwithstanding the fact that the cost of labor in Egypt and India will bear no comparison with that of the United States, and that the Egyptian and East India variety of seed can be handled much more economically than the American product. In the manufacture of prime oil and decorticated cake, the difficulty which would first present itself would be the expense involved—not to speak of the incongruity—of operating delinting machines hulling for the available supplies from a contracted area, which must of necessity be comparatively light. In the event of a plantation being sufficiently

extensive to raise supplies adequate for the consumption of a set of hydraulic presses, the manufacturing processes could be maintained according to the best established principles, but in small quantities efficient work with its usual concomitant — a reasonable profit — become impossible of attainment. The project might be carried into effect with better prospect of success by crushing and pressing the undecorticated seed. By this method the meals and hulls are crushed, heated, and pressed together without distinction, on the exact lines which obtained when the now vast cotton-seed oil manufacturing industry was in its incipiency.

An "off" oil is the inevitable result produced by this crude method. This must be interpreted as a diminution of the questionable profit. The hulls submitted to the same heating process as the meals, and being thus intimately associated therewith, deleteriously affect the color of the oil, and a dark variety is obtained.

The cake as a feeding product would command a comparatively low price, the rough dark hulls distributed over the surface and interior of the cake proving decidedly detrimental to mastication.

In England the Egyptian and other varieties of cotton-seed are in the main worked in this manner, but by reason of the fact that a much less proportion of adhering cotton is found on the English imported seed, it can be manipulated with greater facility than the American product.

In the specified rules of the New York Produce Exchange, with regard to cotton-seed oil, it is stipulated (rule 9) that crude cotton-seed oil, to pass as prime, must be made from decorticated seed, and must be sweet in flavor and odor, and free from water and settlings. Obviously, the oil designated as prime, the output of the small plantation oil-mills, would be repudiated as such by the clearly defined rule.

In various parts of the South, small oil-mill plants are located and operated in conjunction with the regular me-

chanical appliances essential to the cotton-grower on an extensive scale, but the character of the work executed precludes the possibility of reasonable returns.

Many have long been abandoned, and are to-day rusting away, being permanent reminders of ambitious projects irrecoverably wrecked. Many of these small mills range in capacity from five to ten tons of seed per day.

The impracticability of saddling an ordinary farm-hand with what may be justly designated skilled labor, in the manipulation of the raw material, is evidenced by the results, and while not wholly precipitating the latter, it unquestionably hastens the inevitable. It will be readily understood that plants operated on a smaller scale than the foregoing will proportionally still further reduce the chances of efficient work. The combination of small rolls, heater, press, and hydraulic pump may be worked to better advantage on any other vegetable product of an oleaginous nature, rather than cotton-seed.

Apropos of small plants, the attention of makers of hydraulic machinery in the United States might be profitably devoted to this class of mechanical work by developing an important industry hitherto dormant. The combination referred to has been regularly made in England and shipped to British colonial possessions for many years past. Colza, sesame (or her seed), castor, linseed, rapeseed, cocoanut, etc., are respectively treated, and the oil extracted therefrom in the location where the products flourish, the same apparatus being brought into requisition in the manipulation of each, when desired. Several of these valuable oil-yielding seeds flourish in the South, and ripen and decay as the seasons succeed each other. Here is a field for enterprising men in many Southern districts.

But to resume the subject under consideration. While the cake produced by a small plant could be consumed by the plantation stock, or in surrounding vicinity, thereby reduc-

ing cost of transportation, the question arises, would the reduced figures obtainable for the unavoidably poor yield of crude oil be sufficiently lucrative to meet increased current obligations by reason of the cost of fuel, labor, repair of machinery, etc., in the manufacturing processes ?

Is it more profitable for the cotton cultivator to dispose of his seed to the crusher at a reasonable price per ton, than to transform the crude material into the manufactured products of oil and cake on his own premises ?

Unless the crushing is continuously maintained on a sufficiently extensive scale to facilitate efficient work, the answer must be in the negative. To manufacture cotton-seed oil by means of the small portable combination previously referred to (the capacity being one or two barrels of oil per day) would be to invite financial disaster.

A cotton-seed crushing plant, having a capacity of about twenty tons per day—that is, twenty tons of oil and cake—can be operated economically and profitably when ruling prices for the crude and manufactured products are normal.

EVILS ATTENDING THE USE OF THE HAIR MAT.—HARD CAKE.—REMEDIAL MEASURES FOR ITS PREVENTION.

Just a word in passing with regard to the press mat system—abolish it without delay. The hair mat is an endless source of annoyance and expense. Where such is in use—and it is a matter for surprise that at this time it has not been abolished—a radical change in that respect should be effected. The extra expense involved by its use for a period of say six or eight months, would pay for the introduction of the bare corrugated plates. There is not to be found in the several hundred oil mills in England a single hair mat in use to-day.

Reverting to the subject of percentage of oil in cake, refiners prefer oil for treatment which has been obtained

under abridged pressure periods, and from cake in which a heavy percentage of oil is retained. To meet the requirement of this case, the subject of reducing the maximum pressure in several of the large mills is said to have been seriously contemplated, but as yet no positive steps have been taken in that direction.

Probably a higher market value for the oil thus obtained might put the suggestion into practical effect, while the residue or cake might be profitably reworked, and the extractable oil obtained under the maximum pressure subsequently.

This would seem the most feasible and practical method as a solution of the question. *Owing to the fact that oil made under short time pressure*—the latter not maintained at the highest point—is much more *susceptible* of manipulation in the refining tanks, and deposits less foots, it is therefore less wasteful than oil made under the maximum pressure maintained unrelaxed for the usual stipulated period.

Under light pressure very much less mucilaginous and vegetable matter generally is pressed out with the oil, consequently less treatment is necessary in the refining, and less waste results than in oil procured by the full-pressure system. The point of distinction to be drawn is embodied in the question, will the extra market value obtained for the refined product counterbalance the loss entailed by the presence of a heavy percentage of oil in the cake ?

From time to time complaints reach the American crusher concerning the hardness of the cake exported to England. It has been asserted by an English agriculturist recently that the sidewalks might be advantageously flagged with some varieties of American cotton and linseed cake !

The foreign stock-feeder needs a soft material, rich in oil, and for which a price is offered far removed from the manufacturer here. The extreme hardness of the cake is attrib-

utable in numerous instances—though not in all—to the presence of abnormal proportions of moisture, and the remedy consists in better cooking and prolonged evaporation. If the English consumer could be induced to purchase the material in ground or pulverized form, the difficulty would be obviated, however hard the original cakes might be; and with regard to the proportion of oil contained in the cake, according to a distinguished agricultural chemist, the cotton-cake meal, which contains a percentage of oil equal to about seven, is the most inviting to the palate of stock, and by far the most nutritive.

The method usually pursued in England in feeding the oil-cake to stock consists in breaking the cake into small fragments, preferably to being served in ground form, owing to the liability of the latter to be carried away by the wind.

As the American farmer is gradually realizing the value of cotton-seed meal as a stock-feeding material, the quantity ground for home consumption is annually increasing. In the not very distant past, the English agriculturist alone fully appreciated the advantages accruing from the use of cotton-seed meal. These conditions bidding fair to become still more important factors in the seed-crushing business than have characterized its past history, it behooves the manufacturer to be suitably equipped with regard to cake-grinding machines, and to operate those which experience has shown to be the most serviceable and reliable in quality of work performed.

LATEST METHODS

FOR

REFINING OF COTTONSEED OIL.

The crude oil is a thickly fluid, dirty yellow to reddish oil of greatly varying quality, according to the good or bad nature of the seed, and nature of season, length of time stored, during which it, the seed, may have become damp and begun to decay or handled in mill with different degrees of care. The lower grades of crude oil contain a higher percentage of free fatty acids, and therefore present a greater loss in refining while also yielding a lower quality of refined oil. On standing for some time a shiny deposit separates from the crude oil.

Owing to the coloring matter and other impurities contained in it, the crude oil is not well adapted for soap making, but requires refining.

The process of refining consists in warming the oil in large tanks, and adding under constant agitation, through a perforated pipe above the tank about 2 per cent. of 30° lye. The quantity, nature and strength of lye used—whether soda or potash, entirely caustic or partly carbonated—depends on the quantity of the oil and the judgment or preference of the refiner. The fatty acids and the lye combine rapidly to form a crude, black, and dirty soap, while the particles will settle and leave the oil above sweet and light in color. If then found necessary, more lye may be added to purify the oil still further.

When the oil is sufficiently refined, it is either allowed to rest at once or first boiled up with about 1 per cent. of salt previously dissolved in hot water to assist clarification; the impurities which settle to the bottom consist of partly formed soap, coloring matter, mucilaginous slime, and water or waste lye. The clear, pale, colored oil is drawn off and washed out with water, and constitutes the grade known in commerce as "summer yellow," the sediment is placed on the market as soap "stock" or "foots."

The oil when refined as described consists of palmatin and olein, the former largely separating out at a low temperature. When the oil is chilled a more liquid portion (mostly olein) may be separated from it, which is very suitable for a salad oil and known as "winter yellow;" the more salad portion (mostly palmatin) is placed on the market as "cotton stearine." By the latter name there is also sold another product, namely, the solid fatty acids from factories making glycerine from cottonseed oil. Unless this is borne in mind the term is apt to confuse.

COTTON OIL FOR SOAP MAKING.

Cotton oil, and especially the refined article, saponifies with difficulty and only gradually by long continued boiling; but the process may be hastened by the addition of other fats or of some soap scraps. The resulting soap is of a white color while fresh, and rather soft, so that the oil is generally used together with fats that form a more solid soap. In order to make a firm bar soap from cotton oil alone, it is therefore necessary to finish it so that the soap should contain but little water. When the soap grows older it turns yellow, acquires a somewhat disagree-

able odor, and, worst of all, certain varieties become covered with yellow blotches. This latter substance (hydro carbon) in the oil, which is not removed by the process of refining, but remains, and finds its way into the soap and, under favorable circumstances, is brought to the surface by the "sweating" of the soap; curiously enough these spots do not appear in the boiled down soap of cotton oil nor in "cold made" soap containing silicate of soda, but on the other hand they are very pronounced in white "settled" soap soon after the same has been made. In rosin soap they are less noticeable.

The commercial refined oil may be bleached if required by the use of Fuller's earth or by potassium bichromate and hydrochloric acid.

In some of the soap works which are operated in conjunction with cotton oil mills as many as twelve grades of laundry soap are made, three or four different grades of castile soaps and several grades of toilet soap.

CAKE ANALYSIS.

Cake analysis, concerning which we have already accorded consideration, is a very essential matter in oil milling. From a stock-feeding or fertilizing standpoint, excessive oil in the cake or meal is not a desirable feature, apart from the loss the manufacturer sustains thereby.

Since oil has been selling at extremely low prices, not a few of the leading manufacturers have designedly increased the oil percentage in their cake with the object of rendering the latter more soft and correspondingly more marketable and at a better price. But this is an exceptional year, and a course similar to the one referred to would prove under ordinary circumstances decidedly unprofitable.

By adhering to the instructions herewith given, concerning the following analytical formula, the true conditions of press room work will be revealed.

In a mill of large capacity it is customary to select a cake from each set of presses, for each watch for analysis. A cake may be selected from each press, or more than one from each, if desired. The apparatus needful is simple and inexpensive, comprising glass tubes and porcelain dishes sufficient for each test of meal made; a pestle and mortar, fine screen and balance complete the outfit, the solvent used being bisulphide of carbon. A small wooden stand will be needed to hold the tubes in a vertical position, with perforations in lower cross-piece, to permit the pointed ends to be inserted therein so that the solvent

and oil may drop unobstructedly into the small receptacle beneath.

TESTING PROCESS.

Take the cake to be tested and saw through diagonally, the fine meal and fragments falling on a previously spread out paper. Avoid passing the saw through the edges of an imperfectly trimmed cake; this is accomplished by breaking off one or two inches from each end. Raise the meal dust and cake fragments and pass through a fine screen. The fragments may be reduced by the pestle and mortar to a mealy consistency, the finer portion being secured as before. Lumpy matter, or fragments, however small, must not be permitted in the meal to be tested, and as an additionally precautionary measure the pestle and mortar are again brought into requisition, and the meal pulverized into an impalpable powder. Five grains of the meal are now carefully weighed by the balance, the weighing being conducted with delicacy and exactness, so that results will be accurate.

The tube, or tubes, are in readiness, each having a small piece of cotton pressed firmly to the bottom. By means of a small tin, or glass funnel, which is inserted into the upper part of the tube to be charged, the weighed meal is now introduced, over which another small piece of cotton is pressed down, the whole being subjected to a moderate strain to secure compactness. When removing the meal from the balance dish to the tube, carefully displace from same adhering particles or dusty matter which remain on sides and bottom, when the dish has been inverted. This may be done with the cotton which is intended to press over the meal, the

funnel being carefully cleaned down with same and the whole pressed into position. A small wire rod and wooden pin, the latter made of a suitable diameter to enter the tube, will be found useful adjuncts in this connection.

The small porcelain dish is now placed immediately under the charged tube and the solvent poured in. The same funnel which introduced the meal will answer this purpose, when the top is closed with a small piece of cotton. The bisulphide of carbon will be observed passing through the compressed meal, and a few minutes later falling into the dish beneath together with the oil. The bisulphide of carbon is added in the following manner. To place this phase of the testing operation before the prospective analyst in the most simple manner, it will be necessary to give dimensions of the glass tubes, which for other reasons it is also essential to explain.

The tube should be about 15 inches long and half an inch wide and blown to a point at one end. Bisulphide of carbon, sufficient to occupy 6 inches of the tube space will suffice for the first charge, when at the expiration of two or three hours about 2 inches more are poured in, and in an hour or so afterward the final addition is made, about 1 inch. A good plan is to have this accomplished late in the day, allowing the solvent and oil to remain over night, when the former will have been almost completely evaporated. However, this is not essential, as when the last charge of solvent has percolated through the meal, the small dishes may be placed over a heater or stove, when the solvent, or moisture, that may be present is removed with facility, leaving the pure cotton oil in readiness for weighing.

Under any circumstances it is necessary to place the

dishes with their contents on the heater or stove, so that possible traces of solvent or moisture may be assuredly eliminated. The dish and oil are now weighed and result jotted down, when the oil is carefully wiped out, the weight of the empty dish ascertained, which deducted from the original figures, or gross weight, gives the exact percentage of oil left unextracted by hydraulic pressure. A good plan is to have the weight of the empty dish beforehand, a distinguishing mark, or number, still further simplifying matters. Of the 5,000 grammes of meal, we will say for illustration, 430 grammes of oil is obtained, or equal to 8.6 per cent. of the weight of meal, which is the exact percentage of oil left in the cake.

The wooden stand, or stands, may be made of sufficient capacity to hold 6, 12 or 20 tubes, or as many as will be required for a regular testing operation, according to mill capacity. A record book should be kept showing results, which may be referred to for purposes of comparison at any time. The method is simple and accurate for practical factory purposes. In this connection ether is generally supposed to be a more powerful and effective solvent, but by following the particulars here laid down a much more simple and practicable factory method will be secured, while being uniformly reliable. Bisulphide of carbon may be purchased at 9 or 10 cents per pound, while ether is many times this price. A pound of bisulphide will suffice for 12 or 14 tests.

One point should be always borne in mind, bisulphide of carbon is extremely imflammable, its vapors even when confined is explosive. No light or fire should be brought into its vicinity. With care in this respect, however, it is easy and safe to handle, and it is not dangerous to inhale a reasonable amount of the vapor, in

spite of its offensive odor—to which, by the way, one soon becomes accustomed.

Writer has used this system regularly for twelve years in preference to all others, and with uniform satisfaction.

As the process we give is sufficiently accurate for factory purposes, we have no hesitation in recommending it, but as a further guard against the possibility of mistake, whether in the actual process or owing to the liability of scales getting out of order, it is well to have a regular laboratory test made about every three months by a practical chemist.

The "National Provisioner" Analytical Laboratory, 284–286 Pearl Street, New York, makes a specialty of this kind of work, and is prepared to make analyses of oils, cake, meal and soap stock. (See advertisement on another page.)

THE APPARATUS REQUIRED.

For the testing of cake a certain amount of apparatus is necessary, but it is not of an expensive nature. In fact the method is so simple that only a small outfit is required. On the following page will be found a complete list of the materials and apparatus, accompanied by the prices for which same may be obtained. If several samples are to be tested at one time, additional percolating tubes, stand and clamps, funnels and beakers should be ordered.

APPARATUS FOR COTTONSEED OIL CAKE ANALYSIS AND COST OF SAME.

1 glass percolating tube, 15 in. x ½ in. bore	$0.35
1 stand and clamp to hold same	.90
6 wide beakers, each tared, No. 0	1.25
1 Wedgewood mortar and pestle, No. 0	.55
1 brass gauge sieve, 6 in., No. 80	.55
1 balance	4.75
1 set metric weights	1.75
8 oz. absorbent cotton	.30
¼ oz. funnel	.15
5 lbs. bisulphide of carbon and can	1.00
	$11.55

ADDENDA.

Since the foregoing matter was first published we have heard from a number of mill men who have experienced considerable difficulty in maintaining the recording thermometer on a uniformly working basis and that they have abandoned it for that reason. This is regrettable, but in the absence of adequate mechanical help in many mills, is presumably unavoidable, scientific instruments demanding more or less scientific management to render success assured. The delicate mechanism of the gauge with unskillful setting up or management is prone to get out of order—all such instruments are—and rather than give the apparatus the attention its importance deserves, it was forthwith cast aside. The system is satisfactorily working to-day, and it would well pay the cotton seed crushers to give consideration to these details which are conspicuous and profitably operated in other lines.

The steam pressure recording gauge is, however, something which should not be absent where a steam plant is in operation under any consideration whatsoever. It requires no special care and rarely gets out of order, and is, in brief, an invaluable aid in economical mill running.

In connection with cotton seed interest of to-day, a noticeable feature consists in the tendency to take advantage of the diversified industrial interests which its products permit of. Several of the most up-to-date oil mills with co-operative interests consist of refinery, lard plant and soap factory, in addition to the mill proper. The refineries are of various capacities in conformity with that of the mill with which each is connected, all grades

of refined oil in some instances being produced, inclusive of salad and miners' grades.

Another feature of lasting importance to the trade, and which the "National Provisioner"—the recognized organ of same—has uniformly advocated, in season and out, consists in the salad oil thus made being marketed for just what it is, refined cotton oil, purely and simply. It is time the fallacious idea should be exploded that a superior product such as refined and edible cotton oil should depend for the extent of its distribution and general consumption upon the precarious and deceptive method of being marketed under the name of olive oil. No effort should be made to conceal the real nature of the article; it is unnecessary, as upon its individual merits and the degree of push which the refiners themselves display, unlimited possibilities await this phase of the business. The prejudices against cotton oil for such purposes was so strong that several years ago when the business was first inaugurated it was found absolutely impossible to market the article under its rightful name. This prejudice has been very largely removed not only in the United States but throughout Europe, where immense quantities are annually consumed. The principal restaurants in Vienna, Paris and London have replaced the old Lucca olive oil with this new salad cotton oil.

Among the most recent firms who have thus displayed commendable enterprise in undertaking the various projects referred to, and it may be added on a most extensive scale, may be mentioned the Georgia Mills and Elevator Co., of Macon, Ga. The capacity of the refinery is 300 barrels per day and that of the soap factory from 50,000 to 75,000 pounds per day.

A ton of upland cotton seed has been estimated will

yield theoretically, according to Prof. Warrand, of Savannah, 25 pounds No. 1 lint worth 2½ cents per pound; 200 pounds No. 2 lint, recoverable by polishing the seed, worth 1½ cents per pound; 20 per cent. of starch and cellulose, worth by approximating their value to corn or rye, about 1½ cents per pound on 400 pounds; 20 per cent. of portein matter, 400 lbs., at 2 cents; 50 gallons of oil worth (loose) 20 cents. The average yield per ton of seed is 25 pounds No. 1 lint at 2½ cents per pound; 35 gallons oil (loose), at 20 cents; 750 pounds cake at 15 cents, and 1,050 pounds hulls worth $2.00 per ton. This would show that by the present system a little more than one-half of the theoretical value of the seed is recovered.

It is safe to assume, however, that the average seed produced in the United States yields under the present mode of treatment about 2 gallons of oil to 100 pounds of seed.

Mr. D. A. Tomkins, of the D. A. Tomkins Company, Charlotte, N. C., compares the work of an old or badly constructed mill with that of a modern and well designed mill as follows, the year selected being what was considered an unremunerative one.

Estimate of results in an old or badly constructed mill from one ton of seed, mill capacity being about 5,000 tons per season:

Oil	35 gallons.
Meal	675 pounds.
Hulls	950 "
Lint	15 "

Estimate of a well designed mill of a similar capacity from one ton of seed:

Oil	40 gallons.
Meal	675 pounds.
Hulls	950 "
Lint	30 "

The difference in the yield of oil per ton of seed as here shown is striking, the loss entailed in a single season's run by the proprietor of a mill of the old style being very heavy.

DELINTING COTTON SEED.

Within the past year an important industry has sprung up in the exportation of delinted seed for the European market. The superior quality of oil which prime American seed will produce under suitable treatment, is proving a powerful incentive to its further development, and parcels arriving abroad, especially in Liverpool, England, where seed crushing interests are of considerable moment in the local industries, are largely picked up. There are those connected with the industry who look with decided disfavor on this latest and hitherto considered impractical enterprise, now developing in this line. In the event of the business assuming important proportions it is feared the home-made oil will be placed at a disadvantage by being forced to compete with the oil made from American seed abroad, thus to a corresponding extent damaging the industry here. It is certain, however, that the requirements of this new export trade with regard to the necessity of thoroughly denuding the seed of its adhering lint, has taught the home trade a highly useful lesson, which it is hoped they will take full advantage of. While the denuded and polished seed occupies very much less space than ordinary crude seed, while lessening if not entirely

removing the risk of heating under ordinary conditions, thus rendering its transportation and storage much more economical, the prime factors in fostering the export trade, it has been incidentally demonstrated to the mills that a precisely similar policy pursued in milling operations will redound much to their profit, for the reason that a substantial increase in linters will be the direct result. The new delinting machines therefore which are now in operation in several of the principal seed distributing centers in the South, should be in operation in every oil mill. The operation of a machine of this character, which effectively removes the last vestage of lint from green seed, would net the oil miller from $3 to $4 extra per ton. It may be opportune to observe, it has been demonstrated, that polished seed will germinate much more quickly than lint covered seed, maturing in from one to two weeks earlier.

As the trade will be naturally interested in anything which gives assurance of increased returns in the regular running of the mills, we take pleasure in giving details of the machine which has rendered possible the perfect cleaning and polishing of cotton seed on a manufacturing scale. The invention is the property of the American Manufacturing & Export Company, organized under the laws of New Jersey, with a paid-in capital of $500,000. This is the first successful machine of the kind that has ever been perfected. In 1885 a mill owner in Liverpool developed a process to burn the fiber from cotton seed, but it was not a success, as it partially destroyed the seed. A Mr. Green, of Jackson, Miss., in 1887 discovered that sulphuric acid would burn the fiber from the seed, and that a diluted bath of this acid would carbonize the fiber so that it could be removed by washing. This process

was sold by the American Cotton Oil Co., and it was this circumstance that first called the attention of inventors throughout the country to the fact that some practical method of doing this work was in great demand. Sulphuric acid after many trials was abandoned, as the process was not only found too expensive but it damaged the seed both for exporting and manufacturing. Efforts were then made to devise some mechanical means of removing lint. Mr. Bugg's machine consists of four upright pillars with a vertical shaft midway between, to which four circular plates are fastened. Upon these plates is an emery abrading surface and three inches above there are circular brushes of the same size as the plates, but each with a large circular aperture in the center. These brushes are held stationary by arms from the uprights while the shaft to which the plates are attached revolves. The shaft plates and brushes are encased in a cylinder of zinc sheeting, while between each pair of plates is a hopper to convey the seed from one plate to another through the apertures in the brushes. The seed then passes in at the top of the machine and through the aperture in the centre of the first stationary brush. By the rapid revolutions of the shaft the seed is rubbed between the brush and the first emery plate, and part of the lint is removed. It then passes outside the circumference of the first plate into the second hopper and through the aperture in the second brush to the second plate, where the same process is gone through with, and so on through the series of four plates, at the end of which the lint is carried off to an outhouse by means of a fan and the seed thrown out at the bottom of the machine entirely free from lint cotton and in a highly polished state.

As we have already stated, while the introduction of a delinting machine of the character described is looked upon by progressive mill men as a decided advance step in enhancing the value of the business, exportation of the seed thus delinted is looked upon with disfavor for other reasons than those mentioned. It is predicted that an increasing volume of exports will have the effect of advancing seed values, a circumstance which it is needless to say would have effect of giving the home seed crushing interests a pronounced set back.

A delinting machine invented by J. H. McCormick, and tested in New Orleans, gave the following results as compared with the old system:

By the old method 2,000 pounds gave 800 pounds of cake, 288 pounds of oil, 32 pounds of lint and a loss of 890 pounds; by the new method 2,000 pounds gave 1,350 pounds of cake, 360 pounds of oil, 200 pounds of lint and with a loss of only 90 pounds.

FILTER PRESSES

AND

COTTON OIL MILL MACHINERY.

Concerning the filter press in the classification of oils, it is desirable that something further in the way of descriptive matter should appear in this treatise with regard to the several American makes now on the market. A form of press worthy of especial mention consists of thirty perforated plates, having cloths resting in the corrugations of the cast iron, if desired, or caused to grip the cloth only. A relief-valve is attached to the feed-pipe, while quick-opening and closing movements, together with suitable drainage-pipe and floor-pan, are also important features of this design. Attached to each outlet a small cock is fitted, by means of which the flow is regulated.

This design has a bottom corner-drainage and centre-feed, with chambered plates, and is constructed by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio. It is admirably adapted to the requirements of linseed and cottonseed oil mills, and refineries of vegetable oils generally. The accessibility of the parts, and facility with which the cloths may be scraped or removed, form a very desirable feature of the machine. The size of the plates is 24 inches; the cubical contents of one chamber is 484 inches, thickness of cube 1 inch, and working pressure per square inch limited to 150 pounds.

A form of press especially constructed by this enterprising firm to meet the requirements of fine work, is meeting with marked favor. It is also used in many pharmaceutical preparations for the removal of slight

cloudy substances, causing the fluid to pass out in a transparent condition. It is a close filtration press, and intended for both cloth and filter paper as filtering mediums. There are three sizes made—18, 24 and 32 inches respectively. The working-pressure maximum is 150 pounds per square inch, the area of the 32-inch plate being 900 square inches. All parts of these machines are interchangeable, and can be replaced without delay.

The Sperry Filter Press is deserving of consideration, inasmuch as it possesses distinguishing and valuable features, the result of practical experience. The plates used in this are planed twice on each side and will pack tight under the heaviest pressure. The casings are heavy, while large long bearings combine to make the press rigid. Writer has known of several instances where defectively constructed filter presses of English make, unable to carry the load of plates, sagged, causing very considerable difficulty and expense in bracing them. With the Sperry Press this is impossible of occurrence. As is well known, the efficiency of all filter presses depends entirely on the plate. The plate of this make of press is different from all others in the shape and conformation of the grooves. The radially arranged grooves lead the liquid directly to the outlet. They are deeply cut, rounded where they come in contact with the cloth and of such a cross section that the hug of the cloth cannot close the passage. They do away with the necessity for the use of perforated metal, and we have been informed by users that they save fifty per cent. in the wear of cloths, produce a dryer cake and render the action of the press much more rapid than the old style. D. R. Sperry & Co., of Batavia, Ill., are the sole owners. A patent to cover the device is now being secured by the company.

W. R. Perrin & Co., of Chicago, make an excellent filter press. This press consists of a series of round or square plates of cast iron, or other suitable metal, hung upon the press rods. By means of a large steel screw the follower is forced against them, holding them tightly between the follower and bed.

The plates have concave faces each side, the rim or outer edge being finished to a uniform thickness, and wide enough to avoid all unnecessary wear on the filter cloths, and forming tight joints.

Where it is desirable to make the cake more than the ordinary thickness, extension rings are used between the plates. The concave surfaces of the plates have grooves, in which the liquid may pass off; the drainage is increased by several short, straight grooves, running across the other ones at different distances, at the bottom of the plate, toward the outside channel and the outlet. A hole in the center of each plate affords a channel through which the material to be filtered is forced when press is charged.

A quick return motion on the follower can be effected so that two or three turns of the screw releases an iron block between screw and follower, which will then swing out of line of the screw. The follower, by means of a crank attached to the roll shaft, is easily and quickly run back, allowing the chambers to be opened and the solid matter or residuum removed.

This latter system is now a feature of the modern filter press, and is much superior to the original makes.

The Niles Tool Works, of Hamilton, O., the well known engineers and builders, manufacture filter presses of all types with and without single or double washing apparatus, side or center feed. Also without any fixtures

such as perforated plates, center screws, cocks, etc., all as may be desired, They make them for any thickness of cake within practical limits. Also build presses with frames. The same general principle which distinguishes the modern press from the type constructed say 15 or 18 years ago is at once apparent on an inspection of the Niles make.

Special trial presses will be furnished by each of these houses. The presses of the foregoing makes are extensively used throughout the United States in the refining and filtration of lard, tallow, cotton oil, china clay, colors, yeast, chemicals, inks, varnish, acids, white lead, whiting, starch, syrups, glucose, paraffine, stearine and vegetable oils, etc. Presses of all sizes are now regularly made by these leading houses. Filtering medium and suitable pumps are also furnished together with all necessary equipment.

CONVEYOR AND OTHER MILL APPLIANCES.

The illustration in another part of this book shows the principle of the Caldwell Conveyor, which is made by the H. W. Caldwell & Son Co., of Chicago. The special advantages which this conveyor possesses are: economy of power, noiseless operation and durability. It is estimated that there is nearly one and a half million feet of this conveyor in use in cottonseed, linseed and castorseed oil mills. The Company will be pleased to furnish further information to prospective purchasers, while also supplying a comprehensive and illustrated catalogue, which explains every detail of construction and operation and the practicability of its appliance.

It is worthy of note that the Caldwell Conveyor is

used exclusively in about ninety per cent. of the cotton oil mills of the South, the peculiar advantages of its construction making it especially adapted for handling seed.

With regard to seed, the Company also make a very excellent screen, also a bolting chest. Their duplex hydraulic valve which controls the pressure used for the extraction of the oil is ingenious, while proving an important economic factor in saving the press bagging.

The Buckeye Iron and Brass Works, of Dayton, O., of which Mr. Chas. E. Pease is President, makes a specialty in the line of machinery, with regard to the building and equipment of cotton and linseed oil mills of any desired capacity. Special attention is called to the heating or cooking kettle. The company has spent time and money without stint in the perfection of this machine, which consists of three chambers, its particular design rendering possible the discharge of uniformly cooked material, free from lumps and in prime condition for the final operation of pressure. The hydraulic mold, as made by this company, possesses desirable and peculiar features, each machine being capable of forming 200 cakes per hour. The details of the machine and its general make-up combine to render it a most desirable acquisition to a mill having a capacity of four or more presses. The form of press, as made by the Buckeye Brass and Iron Works, is also of peculiar design. The use of this press produces a cake free from ragged and oily edges, and in not a few mills where it is in operation no paring or trimming is done. The firm will be pleased to furnish all further information desired.

Attention is called to the advertisement of the Stilwell-Bierce & Smith-Vaile Co., of Dayton, O., on another page. In addition to making a superior form of filter press, they manufacture all forms of machines used in cotton, linseed and corn oil milling. Pumping machinery for all purposes is also a feature of this house.

The Cardwell Machine Co., of Richmond, Va., make a hydraulic press well suited to the needs of cotton oil milling, and prospective purchasers would do well to write them, not only with regard to this machine, but for other essentials, such as pumps, rolls, heaters, etc.

The Taber Pump, illustration of which appears on another page, is deserving of the careful consideration of cotton oil manufacturers, inasmuch as the possibility of effecting a material saving in time in the handling of large quantities of oil is practicable. The leading crushers already use it. Write the Taber Pump Co., Buffalo, N. Y.

RULES

REGULATING TRANSACTIONS IN

COTTONSEED OIL

AMONG MEMBERS OF THE

New York Produce Exchange.

Rule 1.—At the first meeting of the Board of Managers after their election, the President shall (subject to the approval of the Board) appoint as a Committee on Oils (other than Petroleum) five members of the New York Produce Exchange, who are known as members of the Oil Trade. It shall be the duty of this Committee to properly discharge the obligations imposed on them by these Rules, and also to consider and decide all disputes arising between members dealing in Oils (other than Petroleum) which may be submitted to them. A majority of the Committee shall constitute a quorum, and a decision of a majority of those present at the meeting shall be final. They shall keep a record of their proceedings, and a fee of $15.00 shall be paid to the Committee for each reference case heard by them, to be paid by the party adjudged to be in fault, unless otherwise ordered by the Committee. Provided, however, that nothing herein shall prevent settlement of questions of difference by private arbitration, or as provided for in the By-Laws.

Rule 2.—Sec. I.—Inspectors and Testers of Oils (other than Petroleum) must be members of the New York Produce Exchange, and licensed by the Board of Managers, and must obligate themselves not to buy or sell

on their own account any article they are licensed to inspect or test, such license to be granted only upon written application, endorsed by not less than five members of the Exchange, who shall be regular manufacturers of or dealers in Oils. All licenses shall expire annually, or at any such time as the Board of Managers may designate, and the Board may revoke such licenses any time for cause.

SEC. II.—Weighers of Oils (other than Petroleum) must be licensed by the Board of Managers of the New York Produce Exchange, and must obligate themselves not to buy or sell on their own account any articles they are licensed to weigh, such license to be granted only upon written application, endorsed by not less than five members of the Exchange, who shall be regular manufacturers of or dealers in Oils. All licenses shall expire annually, or at any such time as the Board of Managers may designate, and the Board may revoke such licenses at any time for cause.

RULE 3.—Packages must be good iron bound barrels, new, or thoroughly cleaned refined petroleum barrels, painted or varnished. They must be delivered in good shipping order, and shall not be under 45 or over 55 gallons each, in case of delivery. On delivery of packages other than as above an allowance not exceeding fifty cents per barrel shall be made by seller.

RULE 4.—Tares shall be tested, if required by either buyer or seller, by emptying five barrels of each one hundred barrels, to be taken indiscriminately from the lot. Allowance shall be made for difference in tares in excess of one pound per barrel.

RULE 5.—Deliveries of Cottonseed Oil shall be made by weight at the rate of seven and one-half ($7\frac{1}{2}$) pounds net to the gallon, and in lots of not less than one hundred

barrels at one time, and of not less than fifty barrels at one place.

Rule 6.—Deliveries must be made in New York, at or south of 34th Street, or in Brooklyn at wharf store or wharf south of Navy Yard; or, in lots of not less than one hundred barrels at one place, in New York north of 34th Street and south of 66th Street, delivered to lighter; or, in lots of not less than one hundred barrels at suitable wharf stores at Communipaw, Jersey City, Hoboken, Weehawken or at any railroad terminus thereat, provided that the seller will allow ten cents per barrel for lighterage upon Oil so tendered in the State of New Jersey.

Rule 7.—Cottonseed Oil must be paid for on delivery of the goods.

Sec. II.—All tenders of Oil shall be made between the hours of 9 A. M. and 4 P. M., and unless rejected within twenty-four hours from delivery of sampling order, shall constitute a good delivery.

Sec. III.—When Oil is sampled by order of the Committee, the Inspector shall draw samples from not less than ten per cent. of the lot in question. A fee of Two Dollars for each ten barrels or fraction thereof sampled shall be paid to the Inspector by the party adjudged in fault.

Rule 8.—When a seller fails to notify before three o'clock P. M., two days before the expiration of the month, of his intention to deliver, it shall be deemed a failure of delivery and the buyer is privileged to buy to cover the contract at the market price of the day following, holding the seller for any difference.

Rule 9.—When any dispute shall arise between buyer and seller as to the test, and they cannot agree upon a suitable person to test, the Committee on Oils shall, without charge, appoint a person who shall be paid five dollars

for testing by the party in default, and his decision shall be binding on all the parties interested.

Rule 10.—Crude Cottonseed Oil, to pass as Prime, must be made from decorticated seed, must be sweet in flavor and odor, free from water and settlings, and must produce Prime Summer Yellow Grade by the usual refining methods, with a normal loss in weight.

Rule 11.—Crude Cottonseed Oil, to pass as Choice, must be made from decorticated seed, must be sweet in flavor and odor, free from water and settlings, and must produce Prime Summer Yellow Grade by the usual refining methods, with a normal loss in weight, and shall test not exceeding one per cent. free fatty acid.

Rule 12.—Summer Yellow Cottonseed Oil to pass as Prime, must be brilliant, free from water and settlings, sweet in flavor and odor, and of straw color, not reddish.

Rule 13.—Winter Yellow Cottonseed Oil, to pass as Prime, must be brilliant, free from water and settlings, sweet in flavor and odor, of straw color, not reddish, and must stand limpid at a temperature of 32° F. for five hours.

Rule 14.—Summer White Cottonseed Oil, to pass as Prime, must be straw white to white in color, brilliant, and sweet in flavor and odor.

Rule 15.—Winter White Cottonseed Oil, to pass as Prime, must be straw white to white in color, brilliant, and sweet in flavor and odor, and must stand limpid at a temperature of 32° F. for five hours.

Rule 16.—All sales of Soap Stock, unless otherwise specified, shall be on a basis of 50 per cent. fatty acids; provided, however, no Soap Stock containing less than 45 per cent. of fatty acids shall be a good delivery.

Rule 17.—Settlement of contracts for Cottonseed

Oil shall be made on the basis of fifty gallons to the barrel.

Rule 18.—Settlement of contracts for Cottonseed Oil shall be made at the mean between the prices bid and asked on the Floor of the Exchange on the day of settlement, it being understood, however, that a settlement cannot be substituted for a performance of contract except by mutual consent.

Rule 19.—Either party to a contract, prior to or upon signing the same, shall have the right to call an original margin of One Dollar per barrel, and either party may call for margins to meet variations in the market of one cent per gallon, and all margins called before 12 M. must be deposited before 3 P. M. When an original margin has been called, no additional margin can be called until variations of the market exceed the original margin.

All margins on contracts shall be deposited in one of such Trust Companies, Banks incorporated by the State, or National Banks, as may have been designated for this purpose by the Finance Committee of the New York Produce Exchange. In case of failure of any Bank or Trust Company in which such margins have been deposited, it shall be the loss of the party or parties to whom it may be found to be due, taking the average price of like deliveries on the day such Bank or Trust Company failed as a basis of settlement.

When margins are called, originals or for variations in the market, certified checks must be drawn to the order of the Bank or Trust Company in which they are to be deposited. Checks must be sent to the Superintendent of the New York Produce Exchange, who shall deposit them and get a certificate of deposit, made payable on the order of the Superintendent of the New York Produce Ex-

change, and to the order of the buyer and seller. As soon as the Superintendent has received the certificate, he shall send it to the party making the deposit, and an abstract of the same to the party calling the margin. In settlement, the Superintendent shall ascertain the amount due each of the parties at interest, and shall endorse the amount due each on the certificate over his own signature, as instructed by both parties. In case the two parties do not agree as to the amount due on a margin receipt, either of them may refer the matter to the Committee on Oils for decision, which shall be final. On the decision of said Committee, the Superintendent of the Produce Exchange, on being informed thereof, shall promptly endorse to each party the amount each shall be entitled to by such decision.

In case of the absence of the Superintendent, the President of the New York Produce Exchange or the Chairman of the Finance Committee shall act in his stead under this Rule.

RULE 20.—Fictitious sales or false reports of sales are positively forbidden, and will render the parties concerned liable to suspension or expulsion from the Produce Exchange.

RULE 21.—All transactions in Cottonseed Oil among members of the New York Produce Exchange shall be governed by the above Rules; but nothing therein contained shall be construed as interfering in any way with the rights of members to make such special contracts or conditions as they may desire.

RULE 22.—No change shall be made in these Rules by the Committee on Oils before submitting the same to a meeting of the Oil Trade, properly called, at which eight shall constitute a quorum.

BUTTERINE

AND

MARGARINE MANUFACTURERS IN EUROPE.

AUSTRIA.

Wiener, Fleischhauer Co.....Vienna

BELGIUM.

Joseph F. A. Albers.....100 Carnot, Antwerp
Ct. Bal & Co.....17 la Bontique, "
Anton Jurgens (Ep Smekens)..... "
C. Hoppenbrouwers.....5 Joseph Lies, "
G. Lamovrie.....Jardin des Arbaletriers, "
Linssen Linssens.....53 Nationale, "
Emile Vaerwyck.....30 Van Geert, "
P. Vanougt.....75 Deurne, "
Gustav Van Wint.....9 Juifs, "
Wickens, Pease & Co. (Ltd.)..23 St. Catherine, "
Peeters et Cie .....1 Rue Petite, Brussels
Pierre Aen et fils.....Ensival-Leg-Verviers

DENMARK.

K. Kundsen.....Nakskov

ENGLAND.

Clarke & Creswell (Agents) { 2 Gresham B'dgs., Basinghall St., London, E.C.
Otto Monsted....Factories, { Southall, near London. Godley, near Manchester.

GERMANY.

Van Den Bergh.....Breslau
Halpaus & Peikert..... "
Kosdimsky Co..... "
Steiner & Co..... "
Gabriel Berlin.....Cologne
W. Bornheim & Schanzleh..... "
Meyer Cahen..... "
Bernhardt Calmer..... "
S. Hollender..... "
Benedikt Klein..... "
Strobel & Co..... "
Gebr. Baum.....Elberfeld
Jacob Brocker..... "
F. A. Isserstedt..... "
W. F. W. Proll, Jr..... "
Actien Gesellschaft (formerly Kron, Evers & Co.), Flensburg
Frankfurter Margarin Gesellschaft, Frankfort-on-the-Main
Anton Jurgens.....Gogh
Mohr & Co.....Hamburg
C. Beuermann.....Hanover
Meyer, Kamp & Reissner..... "
Schwencke & Co..... "
Renner & Held.....Leipzig-Schkenditz
Heiner, Lang & Son.....Nuremburg
Salb & Wohl..... "
A. L. Mohr.....Osthofen-on-the Rhine
Jul. Piening..... " " "
L. Rositzky & Witt..... " " "
A. Von Hoyer.....Rostock, Mecklenburg
Wihl Edel.....Schuttorf
P. Knarhoi.....Sonderburg, Schleswig

GERMANY (Continued).

A. G. Margarin Fabrik.....Sonderburg, Schleswig
Sonderburger Dampfmeierci.... " "
Cron & Scheffel.....Wiesbaden
Gebr. Kahn..... "

HOLLAND.

Jos. F. A. Albers.....Bois Le Duc
Nederveen & Co..... "
V. Oppenraay & Co..... "
Van Oppenraay, Lutkie & Co..... "
F. R. J. Albers.....Dordrecht
Cohen & Van der Laan.....Haarlem
J. Van de Griendt & Son, Haarlem, { 27 Great Tower St., London.
Prinsen & Van Glabbeek..... Helmond
Middleburg Margarine Works.....Middleburg
Cramer & Scheers.....Nymegen
Timmerman & Co..... "
Jacques & Co..... "
W. Salomonski & Co.. .... "
Tjessinga & Co..... "
Joh. M. Verschure & Zoon.....Oldenzaal
Anton Jurgens .....Osh
Simon Van den Bergh.....Rotterdam
Hagemann & Co..... "
Van der Hagen & Co..... "
Knaek & Cohen..... "
Laming & Sons..... "
J. Van Renswoud & Zoon..... "
Rotterdam Margarine Factory..... "
Joh. M. Verschure & Zoon..... ..... "
G. Van Disseldorp..... .....Waspik

SCOTLAND.

The Craigmiller Creamery Co., Lim'd,
Liberton, Midlothian

SWEDEN.

Helsingborg's Margarine Factory..... Helsingborg
Venersborg Margarine Factory..... Venersborg

NORWAY.

The Scandinavian Dairy Co..... Christiania
Aktb. Christ. Smorfabrik..... "
Mecur Smorfabrik..... "
O. Mustad & Son..... "
August Pellerin fils & Co..... "
Drammens Smörfabriker (Lim'd)..... Drammen

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COTTON OIL MILLS IN THE UNITED STATES.

ALABAMA.

Tallapoosa Oil Co.....Alexander City
Jefferson County Cotton Oil Mill.....Birmingham
Alabama Cotton Oil Co.....Demopolis
Eufaula Oil & Fertilizer Co.....Eufaula
Columbus Fertilizer Co.....Girard
Alabama Cotton Oil Co.....Huntsville
Jacksonville Oil Mill Co.....Jacksonville
Conchardee Oil Mills.....Lincoln
Alabama Cotton Oil Co.....Mobile
Marion Oil Mill.....Marion
Alabama Cotton Oil Co.....Montgomery
Southern Cotton Oil Co..... "
Lee Fertilizer Co.....Opelika
Campbell & Wright.....Roanoke
Alabama Cotton Oil Co.....Selma
International Cotton Oil Co..... "
Walter Bros.....Sprague
Troy Fertilizer Co.....Troy
Tuscaloosa Cotton Seed Oil Co.....Tuscaloosa
Tuskegee Oil Mills.....Tuskegee
Bullock County Mfg. Co.....Union Springs

ARKANSAS.

Crescent Oil Mill.....Argenta
Arkansas Cotton Oil Co.....Brinkley
Conway Oil Mill.....Conway
Arkansas Valley Cotton Oil Co.....Dardanelle
Arkansas Cotton Oil Co.....Fort Smith

ARKANSAS (Continued).

Arkansas Cotton Oil Mill.....Helena
Arkansas Cotton Oil Co..... Little Rock
Southern Cotton Oil Co..... " "
Farmers' Cotton Oil Mill.....Morrilton
Arkansas Cotton Oil Co.....Pine Bluff
Planters' Oil Mill.....Helena
Consumers' Cotton Oil Co.....Little Rock

FLORIDA.

High Springs Oil Mfg. Co.....High Springs
Madison Cotton Oil Co.....Madison

GEORGIA.

Georgia Oil Co.....Albany
Americus Oil Co.....Americus
Athens Oil and Fertilizer Co.....Athens
Gate City Oil Co.....Atlanta
Georgia Cotton Oil Co..... "
Southern Cotton Oil Co..... "
Georgia Cotton Oil Co.....Augusta
International..... "
The A. P. Brantley Co.....Blackshear
Georgia Cotton Oil Co.....Columbus
Mutual Cotton Oil Co..... "
Rockdale Oil Co.....Conyers
Dawson Oil Co.....Dawson
Elberton Cotton Oil Co.....Elberton
Fort Gains Oil and Guano Co.....Fort Gains
Co-operative Mfg. Co.....Forsyth
Grovania Oil and Fertilizer Co.....Grovania
Lathrop Cotton Oil Mill Co.....Hawkinsville
Middle Georgia Oil and Fertilizer Co.....Hogansville

GEORGIA (Continued).

Jackson Oil Mill.....Jackson
La Grange Oil Mill.....La Grange
Farmers' Oil and Mfg. Co.....Locust Grove
Georgia Cotton Oil Co.....Macon
Georgia Mills and Elevator Co..... "
Macon Oil and Ice Co..... "
Georgia Farmers' Oil and Fertilizer Co.....Madison
Milledgeville Oil Co.....Milledgeville
Monroe Guano Co.....Monroe
Robt. McBride Co.....Newnan
Hand Trading Co.....Pelham
Georgia Cotton Oil Co.....Rome
Southern Cotton Oil Co.....Savannah
Smithsonia Oil and Guano Factory.....Smithsonia
Walton Oil Co.....Social Circle
Valdosta Oil Co.....Valdosta
Excelsior Mfg. Co.....Washington
Waynesboro Oil Mill and Fertilizer Co.....Waynesboro
West Point Oil Mills.....West Point
Walker Bros.....Griffin
Arlington Oil and Fertilizer Co.....Arlington

INDIAN TERRITORY.

Ardmore Oil and Milling Co.....Ardmore

LOUISIANA.

Capital City Oil Mills.....Baton Rouge
Armistead's Oil Mill.....Coushatta
Lafayette Oil Mill Co.....Lafayette
Union Oil Co.....Monroe
Planters' Cotton Oil Co..... "
Independent Cotton Oil Co.....New Orleans

LOUISIANA (Continued).

Louisiana Cotton Oil Co.....New Orleans
Southern Cotton Oil Co..... " "
Standard Cottonseed Oil Co..... " "
St. Landry Oil Mill.....Opelousas
Giovanovich Oil Co.....Natchitoches
Union Oil Co.....New Orleans
Union Oil Co.....Shreveport
St. Martinsville Oil Mill.....St. Martinsville
Union Oil Co.....Vidalia
Freeman & Hayne.....Campti
Feliciana Cotton Oil Co.....Bayou Sara
Gates & Vesey.....New Iberia
Shreveport Cotton Oil Co.....Shreveport
Red River Oil Co.....Alexandria

MISSOURI.

R. B. Brown Oil Mill.....St. Louis

MISSISSIPPI.

Mississippi Cotton Oil Mill.....Canton
Mississippi Cotton Oil Co.....Clarksdale
Columbus Oil Mill.....Columbus
Friar's Point Oil Mill and Mfg. Co.....Friar's Point
Mississippi Cotton Oil Co.....Grenada
De Soto Oil Mill.....Greenville
Mississippi Cotton Oil Co..... "
Planters' Oil Mill..... "
Planters' Cotton Oil Co.....Greenwood
Mississippi Cotton Oil Co.....Jackson
Eagle Oil Co.....Meridian
Mississippi Cotton Oil Co..... "
Mississippi Cotton Oil Co.....Natchez

MISSISSIPPI (Continued).

Natchez Oil Co.....Natchez
Mississippi Cotton Oil Co.....Port Gibson
Port Gibson Oil Works..... " "
Hill City Oil Mill.....Vicksburg
Vicksburg Oil Mill..... "
Refuge Oil Mill..... "
Mississippi Cotton Oil Co.....West Point
Mississippi Cotton Oil Co.....Yazoo City

NORTH CAROLINA.

Swift Creek Mfg. Co.....Battleboro
Charlotte Oil and Fertilizer Co.....Charlotte
Conetoe Mfg. Co.....Conetoe
Fayetteville Cottonseed Oil Mill.....Fayetteville
Marlboro Mill Co.....Gibson Station
Goldsboro Oil Co.....Goldsboro
Laurinsburg Cottonseed Oil Mill and Mfg. Co., Laurinsburg
North Carolina Oil Mill.....Raleigh
Rowland Oil and Fertilizer Co.....Rowland
Farmers' Oil Mill, Shiloh P. O.....Tarboro
Edgecombe County Oil Co..... "
Tar River Oil Co..... "
North Carolina Oil Co..... Wilmington
Weldon Oil and Fertilizer Co.....Weldon
North Carolina Oil Co.....Charlotte
Elizabeth City Oil Mill.....Elizabeth City

OKLAHOMA TERRITORY.

Norman Cotton Oil Mill.....Norman

SOUTH CAROLINA

The Oil and Fertilizer Co..... Abbeville
Anderson Oil and Fertilizer Co..... Anderson
Barnwell Oil Co..... Barnwell
Belton Oil Mill..... Belton
Marlboro Mill Co..... Bennettsville
Mutual Refining Co..... Charleston
Excelsior Oil and Fertilizer Co..... Anderson
Farmers' Oil Mill..... Cathwood
Southern Cotton Oil Co..... Columbia
Coronaco Oil Co..... Coronaco
Darlington Phosphate Co..... Darlington
Dillon Cottonseed Oil Mill..... Dillon
Easley Oil Mill Co..... Easley
Edgefield Oil Co..... Edgefield
Florence Cotton Oil Co..... Florence
South Carolina Cotton Oil Co..... Greenville
Greenwood Oil Mill..... Greenwood
Greer's Cottonseed Oil and Fertilizer Co.. Greer Depot
The Laurens Oil and Fertilizer Co..... Laurens
Marion Cottonseed Oil Co..... Marion
Newberry Cottonseed Oil and Fertilizer Co... Newberry
Orangeburg Oil Mill..... Orangeburg
Ridge Spring Oil Mill..... Ridge Spring
St. Matthews Mfg. and Warehouse Co.... St. Matthews
Seneca Oil Mill and Fertilizer Co..... Seneca
The Produco Mills..... Spartanburg
Ninety-Six Oil Co..... Ninety-Six
Wateree Oil Mill..... Wateree
Sumpter Oil Mill..... Sumpter
South Carolina Cotton Oil Co..... Columbia
Union Oil Mill..... Union
Simpsonville Oil and Fertilizer Co..... Simpsonville

SOUTH CAROLINA (Continued).

Williamston Oil and Fertilizer Co.....Williamston
Winnsboro Oil and Fertilizer Co.....Winnsboro
Liberty Oil Co.....Liberty

TENNESSEE.

Chattanooga Cotton Oil Co.....Chattanooga
Dyersburg Oil and Fertilizer Co.....Dyersburg
Tennessee Cotton Oil Co.....Jackson
Crescent Cotton Oil Co.....Memphis
De Soto Oil Co..... "
Gayoso Oil Works..... "
Southern Cotton Oil Co..... "
Tennessee Cotton Oil Co..... "
Valley City Oil Mills..... "
Tennessee Cotton Oil Co.....Nashville
Trenton Oil Mill.....Trenton
Crescent Oil Mill.....Covington

TEXAS.

Alvarado Cotton Oil Co.....Alvarado
Austin Oil and Mfg. Co.....Austin
Powel Oil Mill Co.....Bastrop
Belcher Cotton Oil Co.....Belcher
Belton Oil Mill Co.....Belton
Blooming Grove Cotton Oil Co.....Blooming Grove
Bonham Cotton Oil Co.....Bonham
Bowie Cottonseed Oil Co.....Bowie
Brenham Compress and Oil Mfg. Co.....Brenham
Bruceville Cotton Oil Co.....Bruceville
Brownwood Cotton Oil Co.....Brownwood
Bryan Cottonseed Oil Mill.....Bryan
Caldwell Oil Mill.....Caldwell

TEXAS (Continued).

Calvert Oil Mill	Calvert
Milam County Oil Mill	Cameron
Cleburne Oil Mill	Cleburne
Comanche Cottonseed Oil Mill Co	Comanche
Corsicana Cotton Oil Co	Corsicana
National Cottonseed Oil Co	"
Houston County Cotton Oil Co	Crockett
Cuero Cotton Oil Co	Cuero
Trinity Cotton Oil Co	Dallas
Cisco Cotton Oil Co	Cisco
Decatur Cottonseed Oil Mill	Decatur
National Cotton Oil Co	Denison
Denton Cotton Oil Mill Co	Denton
Dublin Oil Mills	Dublin
Farmerville Cotton Oil Co	Farmerville
Flatonia Oil Mill Co	Flatonia
Gainesville Cotton Oil Co	Gainesville
National Cotton Oil Co	Galveston
Georgetown Cotton Oil Mill	Georgetown
Goliad Oil Mills	Goliad
Grand View Oil Co	Grand View
Greenville Oil Mill	Greenville
Farmers' and Merchants'	"
Farmers' and Merchants' Oil Co	Groesbeck
Hallettsville Oil Mill	Hallettsville
Lavaca Oil Co	"
Hempstead Oil Mill	Hempstead
Hillsboro Cotton Oil Co	Hillsboro
Honey Grove Cotton Oil Co	Honey Grove
Consumers' Cotton Oil Co	Houston
Merchants' and Planters' Oil Co	"
National Cotton Oil Co	"

TEXAS (Continued).

Southern Cotton Oil Co.....Houston
Italy Oil Co.....Italy
Itasca Cotton Oil Co.....Itasca
Jefferson Cotton Oil and Refining Co.....Jefferson
Kaufman Cotton Oil and Mfg. Co.....Kaufman
Kyle Oil Co.....Kyle
Ladonia Cotton Oil Co.....Ladonia
Lockhart Oil Mill and Power Co.....Lockhart
Longview Cotton Oil Mill.....Longview
Luling Oil Mill.....Luling
McGregor Cotton Oil Co.....McGregor
McKinney Cotton Oil Mill Co.....McKinney
Marlin Oil Co.....Marlin
Buscher Bros.....Moulton
H. Schumacher.....Navasota
Landa Cotton Oil Co.....New Braunfels
Clarksville Cotton Oil Co..... Clarksville
Palestine Cottonseed Oil Co.....Palestine
Paris Cotton Oil Co.....Paris
Rockwall Cotton Oil Co.....Rockwall
San Antonio Oil Works.....San Antonio
Western Cotton Oil, Cold Storage and Mfg. Co.,
San Antonio
San Marcos Oil and Gin Co.....San Marcos
Baumgarten Oil Mill.....Schulenberg
Sherman Oil and Cotton Co.....Sherman
Central Texas Cotton Oil Co.....Temple
Empire Mill Co. ..... "
Terrell Cotton Oil Mfg. and Refining Co.....Terrell
National Cotton Oil Co.....Texarkana
Velasco Cotton Oil Co.....Velasco
National Cotton Oil Co.....Waco

TEXAS (Continued).

Consumers' Cotton Oil Co	Waco
Ellis County Cottonseed Oil Mill Co	Waxahachie
Planters' Oil Co	"
Planters' Cotton Oil Co	Weatherford
Weimar Oil Works	Weimar
Hunt County Oil Co	Wolfe City
Whitewright Cotton Oil and Mfg. Co	Whitewright
Yoakum Oil Mill Co	Yoakum
Shiner Oil Mill Co	Shiner
Floresville Cotton Oil Co	Floresville

FOREIGN COTTONSEED OIL MILLS.

ENGLAND.

Walker & Smith (Lim'd)	Hull
Lomas, Joy & Son	"
Pearson & Bailey	"
Henry Hodge	"
Wright Bros. & Co	"
Bulmer & Field	"
W. & H. Johnson	"
Stuart & Gregson	"
Edward Thompson	"
Chambers & Fargus (Wilcohnlee)	"
John Robinson & Co	Bristol
Foster Brothers	Gloucester
Coad & Brown	Bridgewater
William Durant	Liverpool
Robert Leuthold	"
Earles & King	"
E. & W. Pearson	"
Phœnix Oil Mill Co. (Lim'd)	"
J. Samuelson & Sons	"
W. & W. H. Stead	"
The Liverpool & Bankhall Seed Crushing and Chemical Co	"

CHINA.

Major Brothers	Shanghai

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Chrome Orange.
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Vinegar.
Sodium Sulphite and other Sulphites.
Alum and Aluminum Salts.
Lime.
Preservatives in general.
Spices—Pepper, Coriander, etc.
Dextrine.
Starch—Corn, Potato, Tapioca.
Water.
Boiler Compounds or Purges.
Lubricating Oils—Greases, Compounds in general.
Axle Grease.
Belt Cements.
Belt Greases.
Coal.
Waste Fuel, Gases, and Smoke.
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Lead.
Tin.
Babbitt Metal.
Anti-Friction Metals.
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Fullers Earth.
Pearl Ash.
Silicate of Soda.
Sulphite of Soda.
Depilatory.
Sal Ammoniac.
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Milk.
Cream.
Butter.
Wool Scourers and Cleaners.
"Stick" Curers, or "Stick" Medicine
Salt for Hides—Oleo Oil, Curing, Dry-salting and Pickle, Butter and Oleomargarine, Soap-making, Casings.
Sugar—Molasses, Syrup.
Saltpetre—Powdered, Lump, Crystal.
Borax—Crystal, Powdered.
Caustic Soda.
Soda Ash.
Sal Soda.
Bi-Carbonate of Soda.
Sulphate of Soda or Glauber Salts.

Products.

Beef and Mutton Fats.

Beef, Prime, Edible Tallow for Water, Hardness, Titre, Free Acid Impurities, Uses, Refining Quality.
Non-Edible Tallow—For above tests.
Tallow Oils } Cold Test,
Neatsfoot Oils } Free Acid,
General Impurities.
Bone Tallow—For Hardness or Titre.
Neatsfoot Stocks—For Hardness or Titre.
Wool Grease—For General Impurities, Free Acid.

Oleo and Mutton Stearines.

For Lard and Compounds—Water, Hardness.
For Tanners—Free Acid, Impurities.

Oleo Oil and Neutral Lard.

For Color, Flavor, Odor, etc.
For Hardness, Free Acid, Water.

CHEMICAL AND ENGINEERING LABORATORY (Cont'd).

Lard Products.

PRIME STEAM—For Water, Impurities, Free Acid, Hardness, Color, Taste, Odor, Cotton Oil, Beef or other Tallow, Keeping Quality, Bleaching Quality.

Kettle Lard.

For above tests.

Lard Stearine.

For above tests.

Lard Oil.

For above tests; with cold test.

Lard Compounds.

For Cotton Oil, Tallow, Water, Hardness, Keeping Quality, Climatic Influence, Color, Taste, Odor, etc.

Lard Substitutes.

For above tests.

Hog Grease.

YELLOW AND BROWN—For Water, Hardness, Free Acid, Probable Oil, Yield in Pressing, Bleaching Quality.

Pickles and Brines, Sausages.

Beef Extracts and Beef Fluids.

Pepsin, Pancretin, and other Ferments.

Glues.

Pigsfoot Glue, Bone Glue, Hide Stock Glue, Clear Glue, Foaming Glue, Strong and Weak Glues, Painted or Colored Glues, Paper Maker's Glue, Paper Box Glue, Cabinet Glue.

Butterines.

Creamery, No. 1 Grade, No. 2 Grade, Butterine, Salad Oils.

Cotton Oil.

CRUDE—For Free Acid, Water, Insoluble or Mealy Matter, Probable Loss in Refining, and what suitable for.

YELLOW—For Color, Flavor, Cold Test, etc.; Soap-making, Lard Refining and Cooking Compounds, Miner's and Brewer's Lamp Oil.

WHITE—For Color, Flavor, Cold Test, etc.; Soap-making, Lard Refining and Cooking Compounds, Miner's and Brewer's Lamp Oil.

"FOOTS" OR TANK BOTTOMS—For Oil, Mealy Matter, and Water.

"FOOTS" OR SOAP STOCK—For Water, Total Fatty Acids, Mealy Matter, Free Oil or Free Soda.

COTTONSEED MEAL AND CAKE—For Water, Ammonia, Oil.

Fertilizers.

Including Steam Bone, Raw Bone, No. 1 or 9-20 Tankage, No. 2 or 7-30 Tankage, Green or Pressed and Undried Tankage, Blood, Tank Water or "Stick," Concentrated Tankage, Complete Fertilizers, Hoof Meal—For Water, Grease, Ammonia, Bone Phosphate, Potash, etc.

Wool.

For Shrinkage in Scouring, Water, Dirt, Grease.

A Certificate will be given with every Analysis made.

We hope and expect that our friends, the Packers, Slaughterers, Manufacturers of Oils and Fertilizers, Lard Oil Refiners, Soap-makers, Tallow-renderers, Sausage-makers, and others, will avail themselves of the facilities thus offered, which, as a rule, are accessible and available only to the largest establishments.

We shall be pleased to quote figures on every test or analysis on any of the above articles or several of them. Will be prepared to make arrangements for regular weekly analysis of Oils, Fertilizers, Lard, or any other product.

Will also give particulars regarding size and weight of samples desired. Correspondence solicited.

The National Provisioner Analytical Laboratory,

Official Chemists to New York Produce Exchange,

NEW YORK:

Pearl Street, cor. Beekman.

CHICAGO:

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ADJOINING BOARD OF TRADE.

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